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PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES

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A New Species of *Nebria* Latreille (Insecta: Coleoptera: Carabidae: Nebriini) from the Spring Mountains of Southern Nevada

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***Nebria baumanni* Kavanaugh, new species, is described from the Springs Mountains of southern Nevada (type locality: U.S.A., Nevada, Clark County, Spring Mountains, Deer Creek) and is the only known species of the genus endemic to Nevada. It is most closely related to species of the *meanyi* species group based on features of external form and structure and male and female genitalia. This species is named in honor of Dr. Richard Baumann, in recognition of the many contributions by him and his students to our knowledge of arthropod diversity of the Intermountain and Great Basin regions. A key is provided for identification of adults of all *Nebria* species known to occur in Nevada.**

KEYWORDS: Coleoptera, Carabidae, Nebriini, *Nebria*, new species, Nevada, Spring Mountains, identification key

Nebria Latreille (1810) is a moderately diverse genus of cool- or cold-adapted carabid beetles restricted to the Holarctic Region and mainly to northern and montane portions of that region. Ledoux and Roux (2005) recorded 384 described species and an additional 158 taxa treated as subspecies in the world's fauna. Since that time, several additional species have been described, including two (Kavanaugh 2008; Kavanaugh and Schoville 2009) from North America. Including the latter, the Nearctic fauna as presently known comprises 85 species, including 31 taxa that previously have been treated as subspecies (Bousquet and Larochelle 1993; Bousquet 2012; Kavanaugh 1979, 1981, 1984) but which I now recognize as distinct species.

Recently, I received a few dozen specimens of *Nebria* species from Kipling Will (University of California, Berkeley) for identification. Kip had borrowed most of these specimens from the Monte L. Bean Life Science Museum at Brigham Young University in Provo, Utah, and all were from the state of Nevada. Among those specimens were four from the Spring Mountains of Clark County in southern Nevada that, based on features of external form and structure, were members of the *meanyi* species group. That group currently includes four species: *Nebria giulianii* Kavanaugh (1981), *Nebria lamarckensis* Kavanaugh (1979), *Nebria meanyi* Van Dyke (1925) and *Nebria sylvatica* Kavanaugh (1979). None of these species is known to occur in Nevada, although *N. giuilanii* is found in the California portion of the White Mountains, which cross the California-Nevada border and extend a short distance (ca. 15 km) into Esmeralda County, Nevada. So it is certainly possible that *N. giulianii* may occur in suitable habitat (permanent streams or seeps at elevations above 2300 m, if any exist) on the north or northeast slopes of that range, particularly in the vicinity of Boundary Peak.

Although clearly very similar to members of the other *meanyi* group species, the series of four specimens from the Spring Mountains demonstrated several consistent differences from all of them

in external features. Subsequent detailed examination of male and female internal reproductive structures revealed marked differences from members of the previously described species, and provided strong evidence that this series represents a new, undescribed species.The purpose of this paper is to describe this new species of *Nebria*. A key is provided for identification of adult specimens of all *Nebria* species, including this new one, known to occur in the state of Nevada.

Materials and Methods

This report is based on study of the four specimens from the Spring Mountains, described here as representing a new species, and tens of thousands of additional specimens representing all previously described Nearctic *Nebria* species. Codons used in the text for collections in which specimens have been deposited include:

BYUC — Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT 84602

CAS — California Academy of Sciences, 55 Music Concourse Drive, San Francisco, CA 94118

Methods used in the present study conform to criteria for ranking taxa as distinct species and techniques for handling specimens as described in Kavanaugh (1979)

Measurements: The only measurement here used is standardized body length (SBL), which equals the sum of the lengths of the head (measured from apex of clypeus to a point on midline at level of posterior margin of compound eye), pronotum (measured from apical margin to basal margin along midline), and elytra (measured along midline from apex of scutellum to apex of the longer elytron).

Dissections: Both male and female genitalia were extracted from specimens relaxed in water immediately after it had boiled and to which a few drops of liquid detergent had been added. Genitalic preparations were then cleared in hot 10% potassium hydroxide solution for five to 10 minutes, each constantly monitored to achieve only a useful degree of clearing. They were then rinsed briefly in 10% acetic acid and then repeatedly in distilled water. Preparations of female genitalic structures were next lightly stained with Chlorazol Black E® (Kodak Corporation). After examination, preparations were stored in glycerin in polyethylene microvials and pinned beneath their specimens of origin.

Illustrations: Digital images of whole specimens and particular structures were taken using a Leica imaging system including an M165C dissecting microscope, DFC550 video camera, and two KL1500 LCD light sources. Stacked images were captured and combined into single montage images using the Leica Application Suite V4.2.0. Plates of images were created using Adobe Photoshop CS5.

Systematics

Nebria baumanni Kavanaugh, new species

Figures 1, 2A, 3A, 4A, 5A-B, 6A, 7

Type material.— Holotype (Fig. 1), a male, deposited in CAS, labeled: "NV Clark Co. Deer Crk Spring Mtns 9 June '82 Baumann-Clark"/ "HOLOTYPE: *Nebria baumanni* Kavanaugh sp. nov. 2015" [red label]/ "California Academy of Sciences Type No. 18992". Paratypes (total of 3): 2 females in BYUC and 1 female in CAS with same locality label as holotype, but with the following label: "PARATYPE: *Nebria baumanni* Kavanaugh sp. nov. 2015" [yellow label].

FIGURE 1. Digital images of holotype, *Nebria baumanni* sp. nov. A. Habitus, dorsal aspect; B. Labels for holotype. Scale line = 1.0 mm.

TYPE LOCALITY.— U.S.A., Nevada, Clark County, Spring Mountains, Deer Creek.

DERIVATION OF SPECIES NAME.— It is my great pleasure to name this species in honor of Richard Baumann, who, along with Sean Clark, collected the type series of this species. Throughout his outstanding career, Dr. Baumann and his students have sampled arthropod diversity in the Great Basin and Intermountain regions of the American West more extensively than perhaps any other team. The material that they have collected and made available to others for study, including the specimens described here, have added tremendously to our knowledge of this vast and distinctive region. The species epithet is the Latinized form of his surname name in the genitive case.

DIAGNOSIS.— Adults of this species can be distinguished from those of all other Nearctic *Nebria* species by the following combination of character states: size moderate for genus, SBL of male = 10.4 mm, of females 10.7 to 11.0 mm; body (Fig. 1) black to piceous, dorsal surface without metallic reflection; vertex of head with a pair of paramedial pale spots; elytral microsculpture comprised of moderately impressed isodiametric meshes; antennal scape (Fig. 2A) short, distinctly narrowed basally, widest subapically; pronotum (Fig. 3A) with basal angles rectangular or slightly obtuse, lateral margins with basal sinuation long and deep, sides parallel or slightly convergent basally, with a slight lateral convexity anterior to hind angle in most individuals, lateral

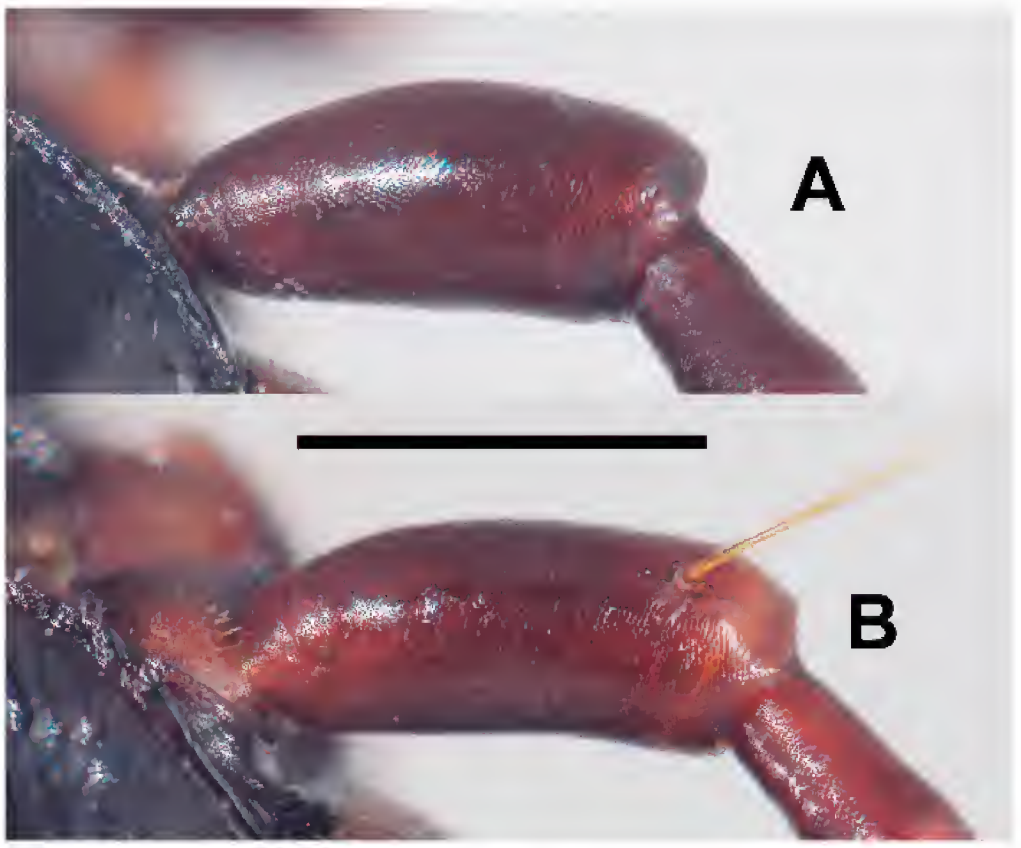


FIGURE 2. Digital images of right antennal scape, dorsal aspect. A. *Nebria baumanni* sp. nov.; B. *Nebria giulianii* Kavanaugh. Scale line = 0.5 mm.

margination ("lateral bead") obliterated from basal one-fifth (posterior to basolateral sinuation), midlateral and basolateral setae present; elytral silhouette subrectangular, distinctly narrowed basally, widest distinctly posterior to middle, lateral margins nearly straight in basal half, humeral angles obtuse and moderately rounded, humeral carinae absent, elytral apices (Fig. 4A) smoothly arcuate laterally and obliquely truncate medially, roundly angulate apically, parascutellar setiferous pore puncture absent; hindwings long but narrowed; median lobe of male aedeagus with shaft thick, evenly arcuate, apical lamella moderately long, slightly enlarged and evenly rounded apically in left lateral view (Fig. 5A), shaft distinctly thickened in region of apical orifice in dorsal view (Fig. 5B); bursa copulatrix of female genitalia (Fig. 6A) with a posterordorsal lobe and a distinct bursal sclerite in the posterior wall of that lobe, spermathecal duct inserted at base of the bursal sclerite on posterior face of posterodorsal lobe; specimen from Spring Mountains of Clark County, Nevada (Fig. 7).

Members of this species are most similar externally to those of *Nebria giulianii* Kavanaugh and other members of the *meanyi* species group, with which they share similar overall body form and size (Fig. 1). They differ from members of all the other species of this group in the following features: dorsal elytral surface without metallic reflection (distinct metallic blue, green or violet reflection seen in members of all the other species); antennal scape (Fig. 2A) short and markedly narrowed basally (scape longer and not or only slightly narrowed basally (Fig. 2B) in members of all the other species); lateral margination ("lateral bead") of the pronotum obliterated posterior to basal sinuation of lateral margin (lateral margination distinctly defined thoughtout pronotal length in members of all the other species); elytral apices (Fig. 4A) smoothly arcuate laterally and obliquely truncate medially, roundly angulate apically (broadly and evenly rounded (Fig. 4B) in members of all the other species); median lobe of male aedeagus (Fig. 5A) with shaft thick and apical lamella moderately long and apically slightly enlarged (shaft slender and apical lamella shorter and not apically enlarged (Fig. 5B) in males of all the other species); and bursa copulatrix of female (Fig. 6A) with a posterodorsal lobe and bursal sclerite on posterior face of that lobe (posterodorsal lobe and bursal sclerite absent (Fig. 6B) from females of all the other species).

See the key below to distinguish adults of *N. baumanni* from those of all other species known to occur in Nevada.

SEXUAL DIMORPHISM.— Males and females of this species are similar in size and form and both have two pairs of posterior paramedial setae near the hind margin of sternum VII. The only apparent external difference between the sexes is in the front tarsi: in males the basal three tarsomeres of the protarsi are broad and have dense pads of adhesive setae ventrally, whereas these tarsomeres are slender and without such setal pads in females.

GEOGRAPHICAL DISTRIBUTION.— At present, this species is known only from the upper Deer Creek drainage on the northeastern slope of the Spring Mountains, Clark County, Nevada. It is also the only species known only from the state of Nevada.

HABITAT DISTRIBUTION.— All specimens of the type series were collected under stones along Deer Creek an unspecified distance upstream of a small picnic area just off Deer Creek Road (State Route 158) [Baumann, personal communication].

PHYLOGENETIC RELATIONSHIPS.— Based on characters of external morphology and form and structure of both male and female genitalia, *N. baumanni* is a member of the *meanyi* species group of genus *Nebria* and most closely related to *Nebria giulianii* Kavanaugh (1981) and *Nebria lamarckensis* Kavanaugh (1979).

GEOGRAPHICAL RELATIONS WITH MOST CLOSELY RELATED SPECIES.— The known geographical range of *N. baumanni* is allopatric with respect to the known ranges of all other species of the *meanyi* species group (Fig. 7). *Nebria giulianii* is known only from the White Mountains in southeastern Mono County, California; and *N. lamarckensis* is known only from the eastern slope of the Sierra Nevada in southwestern Mono County and northwestern Inyo County, California. The nearest localities of these species to the type locality of *N. baumanni* are about 277 and 297 km ENE, respectively, across several lowland gaps of highly inhospitable habitat. The ranges of *N. meanyi* and *N. sylvatica* (see Fig. 7) are far to the north: the former ranging from the mainland coastal mountains of southeastern Alaska and northwestern British Columbia southward along the Cascade Mountain Range from southern British Columbia to Mount Shasta in Siskiyou County, northern California, the latter restricted to the Olympic Mountains of western Washington and Vancouver Island, British Columbia.

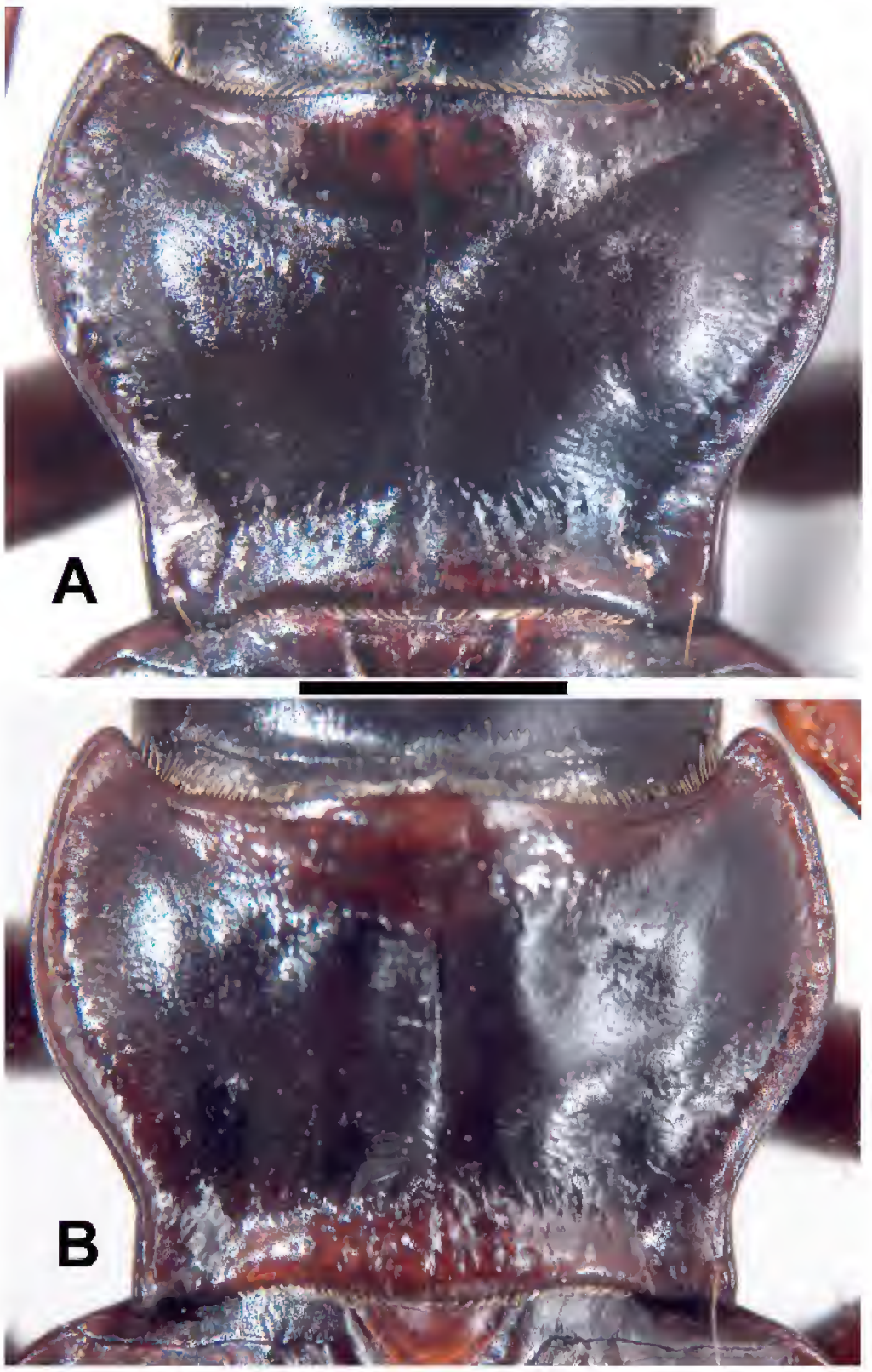


FIGURE 3. Digital images of pronotum, dorsal aspect. A. *Nebria baumanni* sp. nov.; B. *Nebria giulianii* Kavanaugh. Scale line = 1.0 mm.

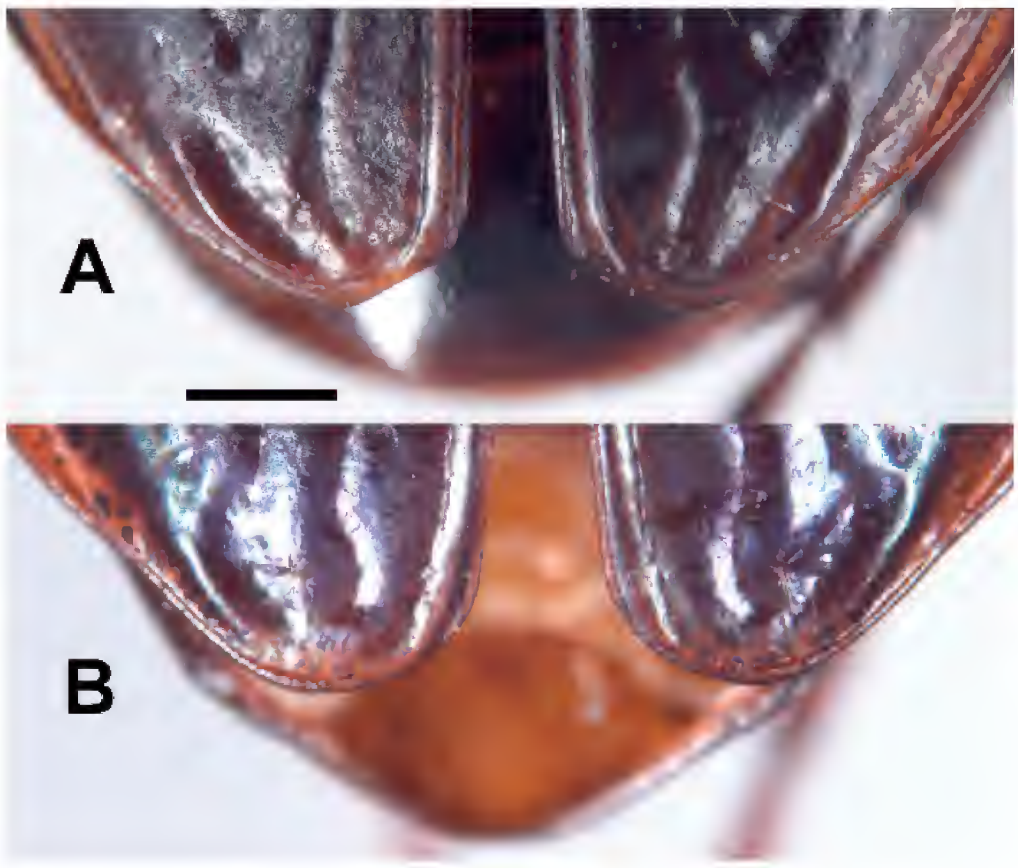
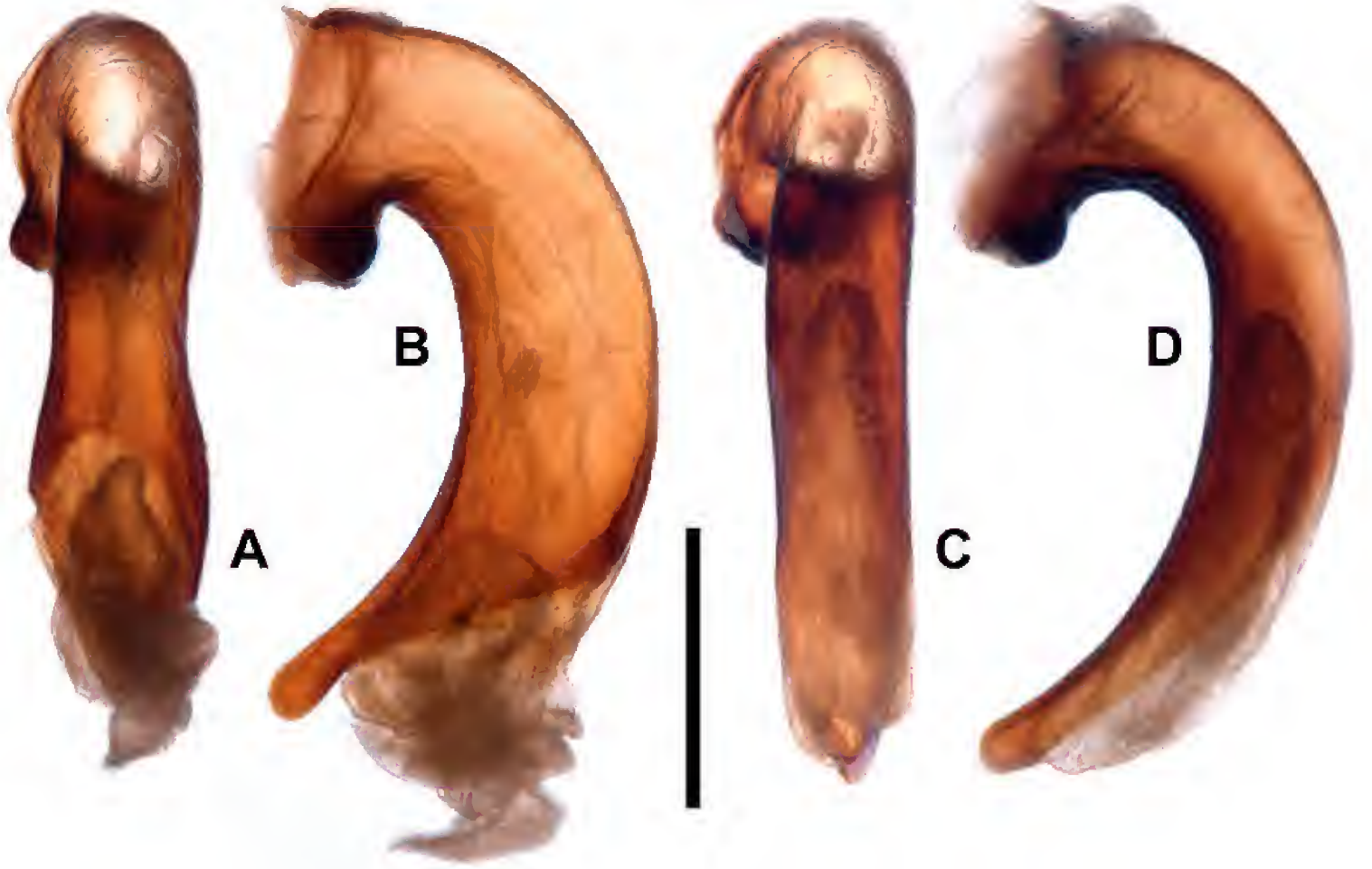


FIGURE 4. Digital images of elytral apices, dorsal aspect; A. *Nebria baumanni* sp. nov.; B *Nebria giulianii* Kavanaugh. Scale line = 0.5 mm.



FIGURES 5. Digital images of median lobe of male genitalia. A-B. *Nebria baumanni* sp. nov.; C-D. *Nebria giulianii* Kavanaugh; A and C. dorsal aspect; B and D. left lateral aspect. Scale line = 1.0 mm.

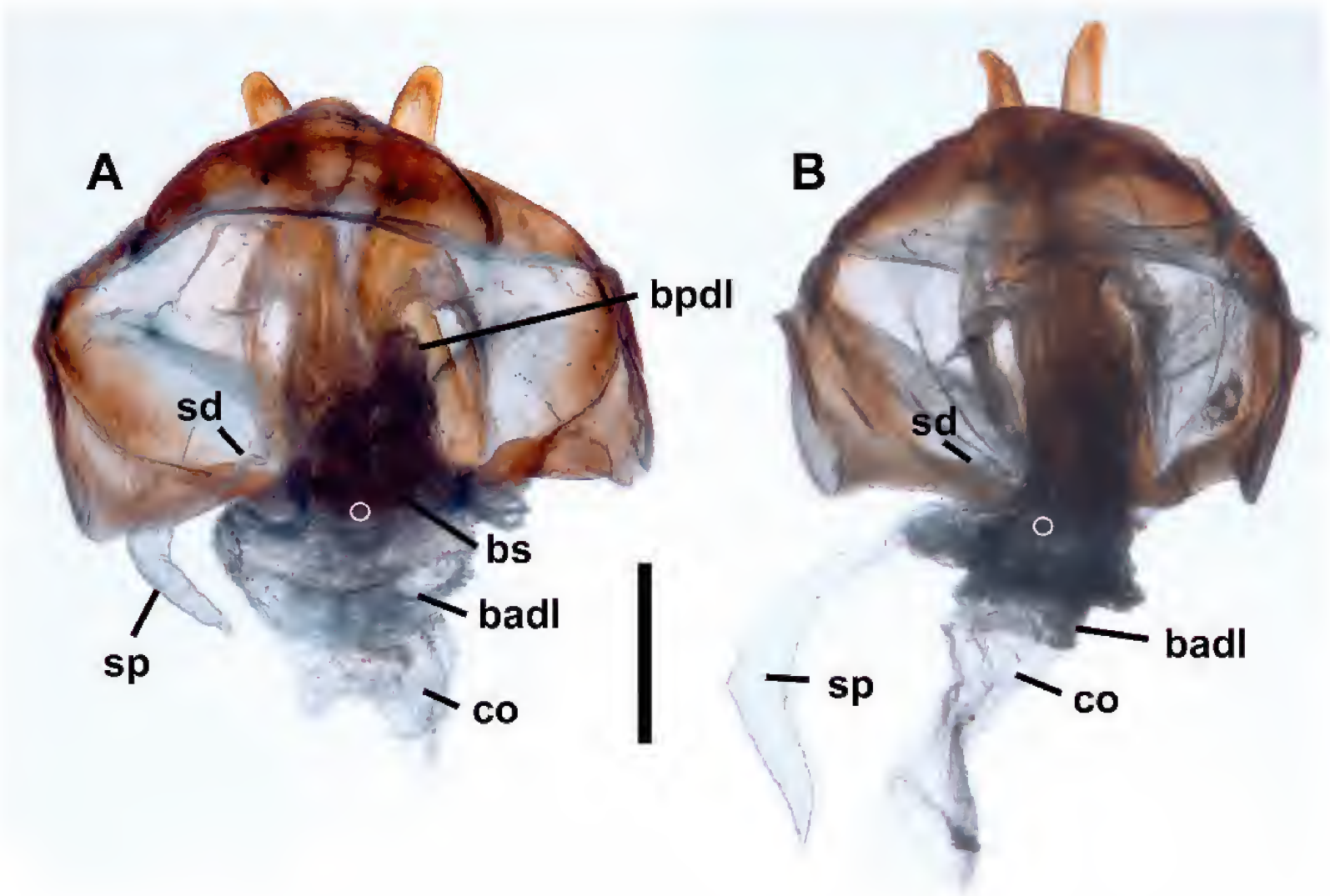


FIGURE 6. Digital images of female reproductive tract, dorsal aspect. A. *Nebria baumanni* sp. nov.; B. *Nebria giulianii* Kavanaugh; badl = anterodorsal lobe of bursa copulatrix; bpdl = posterodorsal lobe of bursa copulatrix; bs = bursal sclerite (in posterior wall of posterodorsal lobe); co = common oviduct; sd = spermathecal duct; sp = spermathecal reservoir; white circle = insertion point of spermathecal duct (at base of posterior face of dorsal lobe). Scale line = 0.5mm.

A Key for Identification of Adults of *Nebria* Species Known to Occur in Nevada

1 Head without pale spots on the vertex (to date recorded only from Elko County, Ruby Mountains) . . . . . *Nebria castanipes* (Kirby)

1' Head with a pair of pale reddish spots on the vertex 2

2(1') Pronotum with basolateral setae present but midlateral setae absent 3

2' Pronotum with both midlateral and basolateral setae present 5

3(2) Leg color black to rufopiceous (to date recorded only from Elko County, Ruby Mountains) . . . . . *Nebria edwardsi* Kavanaugh

3' Leg color pale yellow or tan-orange 4

4(3') Pronotum with lateral margin not or only faintly sinuate anterior to obtuse hind angle, lateral explanation moderately broad (widespread in state) . . . . . *Nebria oblique* LeConte

4' Pronotum with lateral margin slightly but distinctly sinuate anterior to rectangular hind angle, lateral explanation moderately narrow (to date recorded only from Washoe County) . . . . . *Nebria eschscholtzii* Ménétriés

5(2') Elytral silhouette distinctly ovoid; antennal scape short, thick, ovoid, symmetrical or more convex anteriorly, not narrowed basally; (to date recorded only from Washoe County, Mount Rosa area) . . . . . *Nebria ovipennis* LeConte

5' Elytral silhouette subrectangular or subovoid; antennal scape short to moderately long, varied in shape 6

6(5') Antennal scape moderately long, oval and slightly more convex anteriorly, not narrowed basally; elytral silhouette subrectangular; body small to medium-size, SBL males 8.9 to 10.4 mm, females 8.6 to 10.9 mm (to date recorded only from Washoe County) . . . . . *Nebria rathvoni* LeConte

6' Antennal scape short or moderately long, slightly to markedly narrowed basally; elytral silhouette subrectangular or subovoid, body medium- to large-sized, SBL males 10.4 to 12.2 mm, females 10.6 to 13.4 mm 7

7(6') Elytral silhouette subovoid, lateral margins more or less arcuate throughout, widest at or slightly posterior to middle; antennal scape moderately long, slightly to moderately narrowed basally; body medium- to large-sized, SBL males 10.5 to 12.2 mm, females 10.6 to 13.4 mm (to date recorded only from Elko County, Jarbridge and Ruby Mountains) . . . . . *Nebria trifaria* LeConte

7' Elytral silhouette (Fig. 1) subrectangular, narrowed and with nearly straight lateral margins in basal half, widest distinctly posterior to middle; antennal scape (Fig. 2A) short, thick apically and markedly narrowed basally; body medium-sized, SBL male 10.4, female 10.7 to 11.0 mm (to date recorded only from Clark County, Spring Mountains) . . . . . ***Nebria baumanni* Kavanaugh, sp. nov.**

Comments

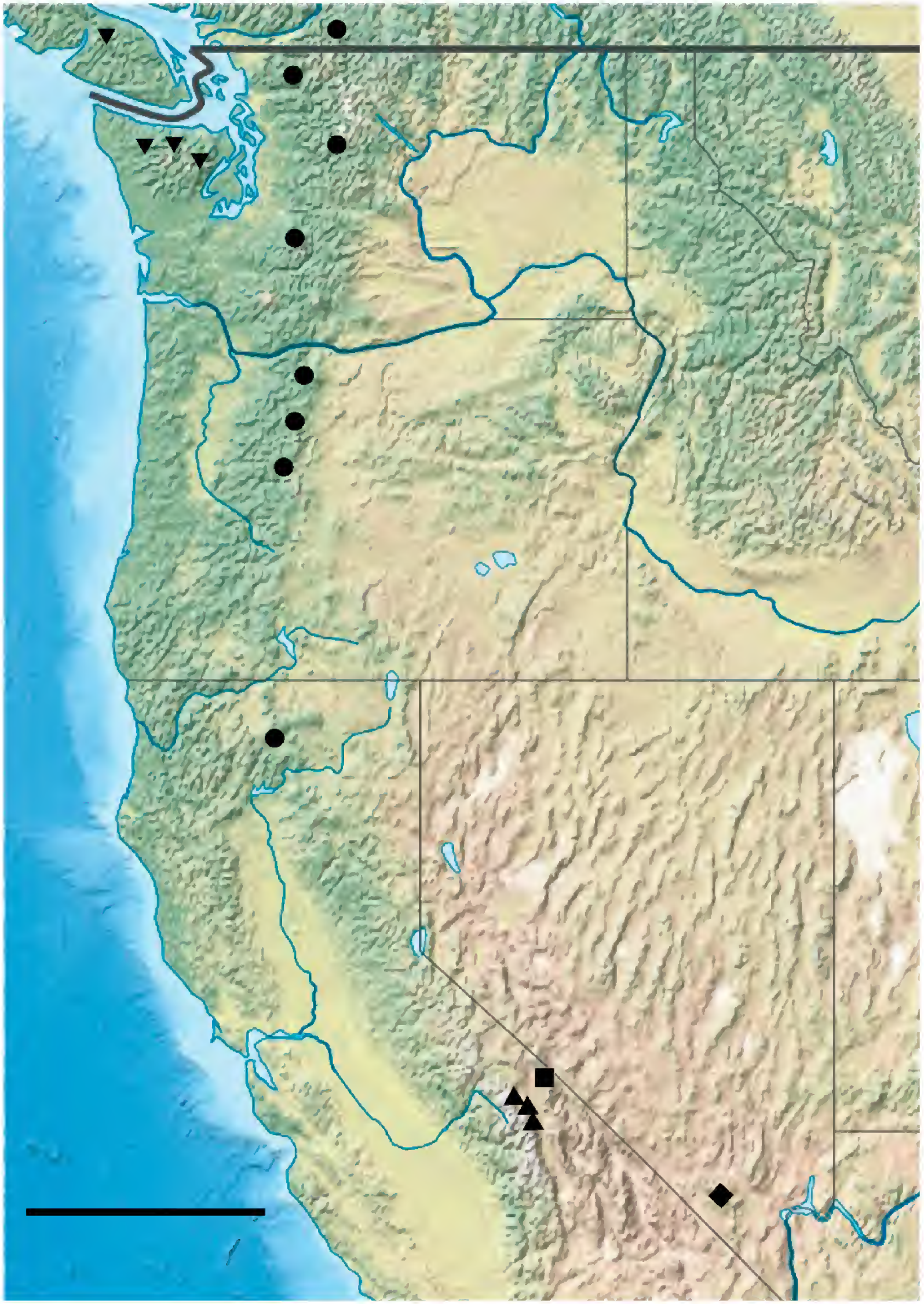
I have spent the last four and a half decades collecting and studying *Nebria* in western North America. During that period, I have had the opportunity to visit repeatedly many montane sites throughout the region. At every one of these sites, I've recorded the same trend — an upward retreat of the lower limit of the altitudinal range of the species that occur there. The magnitude of this retreat is monumental — an average of about 300 meters for essentially every species examined (unpublished data, manuscript in preparation). Because members of all North American *Nebria* species of which I am aware are cold- or at least cool-adapted general predators, I cannot account for such a region-wide and multispecies phenomenon in any way except for climate warming during the past 40+ years.

The beetles described here as a new species were collected just over 33 years ago, and it will be interesting to see how high one must go to find them now, if their habitat exists there at all. I hope that they can still be found extant in the Spring Mountains, and that documenting the existence of this endemic species for the first time will stimulate biologists in the region to look for them.

Acknowledgements

I thank Kipling W. Will (University of California, Berkeley) for making the specimens described herein available to me for study from among material that he had borrowed from the Monte L. Bean Life Science Museum, Brigham Young University. I thank Sean Clark and Richard Baumann at BYUC for approving that loan and also for their notes and recollections concerning the collecting of the type series back in 1982. They also approved the deposition of the holotype and one paratype in the collection at CAS. I also want to thank two reviewers, Terry Erwin and Michele Aldrich, for their helpful comments.

Figure 7 (right). Map illustrating known localities for members of the *meanyi* species group of *Nebria*; black diamond = *N. baumanni* sp. nov.; black square = *N. giulianii* Kavanaugh; black traingle = *N. lamarckensis* Kavanaugh; black dot = *N. meanyi* Van Dyke; inverted black triangle = *N. sylvatica* Kavanaugh. Scale line = 300 km. Based on "USA Region West landcover location map" from Wikimedia Commons, available at *https://upload.wikimedia.org/wikipedia/commons/2/2e/USA_Region_West_landcover_location_map.jpg*.



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Anisotes tablensis (Acanthaceae), a New Species from Southwestern Madagascar

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Anisotes tablensis **is described as a new species from an arid region of southwestern Madagascar. It is one of seven species of the genus now known from Madagascar, and it differs from its Malagasy congeners by the following combination of characters: leaves coriaceous to subsucculent, sessile to subsessile, blades 4–23 mm long and 1.4–3 mm wide; bracteoles absent; calyx 6–7 mm long; and corolla externally pubescent with glandular and eglandular trichomes, the lobes of the lower lip 2.5–3.5 mm long. Some of these characters are shared with species from arid regions of southern Madagascar, whereas others are shared with species from less arid regions of northern Madagascar. The conservation status of this apparently rare species is assessed provisionally as Data Deficient.**

KEYWORDS: *Anisotes*, Madagascar, endemic species, conservation, pollen, floristics

Since Baden's (1981) revision of it, the Paleotropical genus *Anisotes* Nees has been the subject of several recent studies in Africa (Vollesen 2010, 2015), Madagascar (Daniel et al. 2007, 2013), and the Comoros Archipelago (Daniel 2014). Thirty species are currently recognized in the genus; they occur in mainland Africa (21), the Arabian Peninsula (1), Socotra (1), Madagascar (6), and the Comoros Archipelago (2). All six of the Malagasy species are endemic to that island nation, and most of them appear to be local in occurrence. A seventh locally endemic species is herewith added to the known flora of Madagascar. Although it is from an arid region in southern Madagascar, and shows significant affinities to the two other species of *Anisotes* known from nearby regions, the new species also shows some features in common with congeners from less arid regions in the northern part of the country.

Anisotes tablensis T.F. Daniel, sp. nov.

TYPE. MADAGASCAR: **Toliara**: La Table, ca. 20 km N [*sic*] of Toliara, slope and along ridge, 23°25′26″S, 043°46′03″E, 50–120 m, 19 May 2004 (flr), *Z. Rogers et al. 483* (holotype: K!; isotype: MO!). Figures 1, 3.

Divaricately branched shrubs to 4.5 dm tall. Young stems hexagonal, evenly and densely pubescent with a whitish, felt-like covering of antrorsely appressed eglandular trichomes to 0.1 mm long, epidermis not visible, trichomes soon ± restricted to troughs of internodes. Leaves sessile to subsessile, petioles (if present) to 2 mm long, coriaceous, blades oblong to oblanceolate, 4–23 mm long, 1.4–3 mm wide, 2.9–10.5 × longer than wide, gradually attenuate at base, rounded at apex, surfaces pubescent like young stems, margin flat. Inflorescence of axillary or terminal sessile short spikes (usually only 2 fertile bracts per spike) to 9 mm long (excluding corollas), distal

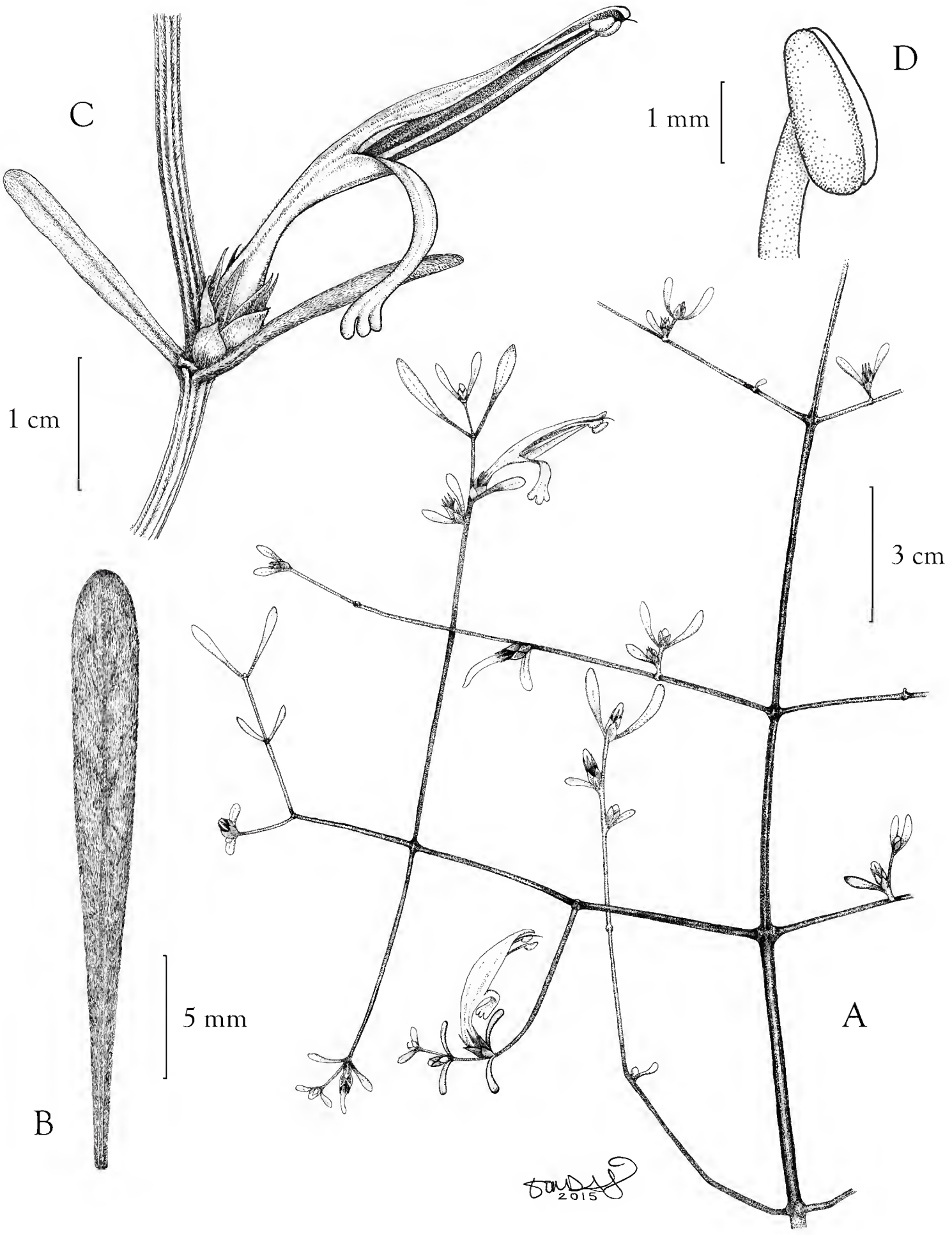

FIGURE 1. *Anisotes tablensis* (*Rogers et al. 483*). A. Habit. B. Leaf. C. Node with axillary inflorescence bearing a flower. D. Distal portion of stamen with anther. Drawn by Tom Davis.

bracts fertile, elliptic, 4.5–5 mm long, 3.6–4 mm wide, apex rounded to obtuse-truncate, abaxial surface puberulent with antrorsely appressed eglandular trichomes to 0.1 mm long and erect trichomes < 0.05 mm long, margin ± hyaline, proximal bracts sterile and smaller than distal ones. Bracteoles absent. Calyx 5-lobed, 6–7 mm long, lobes oblong-lanceolate, 5–6 mm long, 1–1.2 mm wide, abaxial surface pubescent like bracts (or with antrorsely-appressed eglandular trichomes few or absent). Corolla pinkish red, 27–35 mm long, externally pubescent with erect glandular and flexuose to retrorse eglandular trichomes 0.1–0.2 mm long, tube 12–15 mm long, corolla tube length: corolla length = 0.44–0.49, upper lip 17–21 mm long, lower lip 18–19 mm long with lobes 2.5–3.5 mm long. Stamens 20–23 mm long, filaments pubescent proximally with erect glandular trichomes 0.1–0.2 mm long, glabrous distally, thecae 2–2.3 mm long, glabrous, pollen 3-colporate, 6-pseudocolpate (the two pseudocolpi in one or more mesocolpia sometimes fused near one or both poles), 39–41 μm polar diameter (P), 26–30 μm equatorial diameter (E), P:E = 1.37–1.50. Style 28–32 mm long, glabrous, stigma equally 2-lobed, lobes 0.2 mm long. Capsule not seen.

Phenology.—Flowering: May.

Distribution and habitat.—Endemic to southwestern Madagascar (Toliara) where plants occur in the arid thornscrub on soils derived from decomposed coral (sometimes referred to as "coral rag scrub") at an elevation between 50 and 120 meters (Fig. 2).

Conservation assessment.—Because *A. tablensis* is known from a single, relatively recent collection from a population that was not observed during this study, it is difficult to assess its conservation status according to IUCN (2014) guidelines. Based on IUCN criteria for the threatened categories, *A. tablensis* likely has both EOO and AOO (criteria B1 and B2) sufficient for Critically Endangered status, but only one (i.e., one known location; i.e., criterion Ba) of two conditions required for assessment in that category. The only known collection does not occur in a locality that is protected. Lacking further data, this apparently rare species must be provisionally assessed as Data Deficient.

Anisotes tablensis is known only from the type collection. It is the third species of the genus known from the dry regions of southwestern Madagascar. The geographic coordinates given on the

FIGURE 2. La Table in southwestern Madagascar (looking westward toward Mozambique Channel), habitat of *Anisotes tablensis*. Photo by the author.

label of the type are about 2 km southwest of the prominent local mesa-like physiographic feature known as La Table (Fig. 2), from which the epithet is derived. La Table (23°24′32.40″S, 43°46′51.73″E) is a well-known collecting locale in a region of Tertiary limestone about 12 km southeast of the city of Toliara (Tulear) and home to a large number of Acanthaceae. It is also a popular birdwatching site where several rare birds, including the Red-shouldered Vanga (*Calicalicus rufocarpalis*) and Verreaux's Coua *(Coua verreauxi*), are often observed. Given its accessibility, it is surprising that undescribed species are still being found on its slopes and ridge. Two other species of *Anisotes*, *A. divaricatus* T. F. Daniel, Mbola, Almeda & Phillipson and *A. madagascariensis* R. Ben., occur in nearby regions (Daniel et al. 2007), but neither is known from the vicinity of La Table. These three species can be distinguished by the following key:

1a. Leaves sessile to subsessile, petioles (if present) to 2 mm long, blades 1.4–3 mm wide, length:width = 2.9–10.5; calyx 6–7 mm long; corolla externally pubescent with glandular and eglandular trichomes throughout, lobes of lower lip 2.5–3.5 mm long. . . . . *A. tablensis*

1b. Leaves petiolate, petioles to 12 mm long, blades 4.5–38 mm wide, length:width = 0.7–2.7; calyx 1.3–3.5 mm long; corolla externally glabrous or occasionally with a few eglandular trichomes proximally, lobes of lower lip 8–14 mm long 2

2a. Leaf blades broadly ovate to ovate-elliptic to elliptic to broadly elliptic, 14–45 mm long; margin of calyx lobes ± densely ciliate; corolla with internal surface conspicuously lighter in color than external surface, corolla tube 9–15 mm long, corolla tube:corolla = 0.23–0.38, upper lip 20–35 mm long and distally whitish to pinkish along margin, lower lip spirally coiled, 18–28 mm long, lobes 12–14 mm long; stamens 26–33 mm long; capsule pubescent with flexuose to antrorse eglandular trichomes 0.05–0.1 mm long . . . . . *A. madagascariensis*

2b. Leaf blades broadly obovate to subcircular to obcordate to obdeltate to oblate, 5–14 mm long; margin of calyx lobes eciliate to sparsely ciliate; corolla with internal surface not conspicuously lighter in color than external surface, corolla tube 14–20 mm long, corolla tube:corolla = 0.46–0.56, upper lip (11–) 14–18 mm long and lacking a pale margin distally, lower lip recurved to reflexed (not spirally coiled), 11–19 mm long, lobes 8–12 mm long; stamens 15–18.5 mm long; capsule ± rugose-granulate but lacking noticeable eglandular trichomes . . *A. divaricatus*

All three of the species of *Anisotes* from southern Madagascar lack bracteoles and have coriaceous to subsucculent leaves, bracts lacking reticulate venation (or with venation not evident), and similar 3-aperturate pollen. They would appear to pertain to Baden's section *Spiciflori* (Baden 1981; Daniel et al. 2007). Pollen of *A. tablensis* (Fig. 3) greatly resembles that of both *A. madagascariensis* and *A. divaricatus* from southern Madagascar, except for its somewhat smaller polar diameter (39–41 vs. 62.5–7 μm). The four species from northern Madagascar (*A. hygroscopicus* T. F. Daniel, R. Letsara & Martín-Bravo, *A. perplexus* T. F. Daniel, R. Letsara & Martín-Bravo, *A. subcoriaceus* T. F. Daniel, R. Letsara & Martín-Bravo, and *A. venosus* T. F. Daniel, R. Letsara & Martín-Bravo; Daniel et al. 2013) show greater diversity in pollen shape and sculpturing (varying from 2- to 3-aperturate) and have membranous to subcoriaceous leaves, bracteoles, and bracts with reticulate venation evident. *Anisotes tablensis* shows greater similarities to those four species than to the other two southern ones in the following characteristics: calyx length, external pubescence of the corolla, and length of lobes of the lower lip.

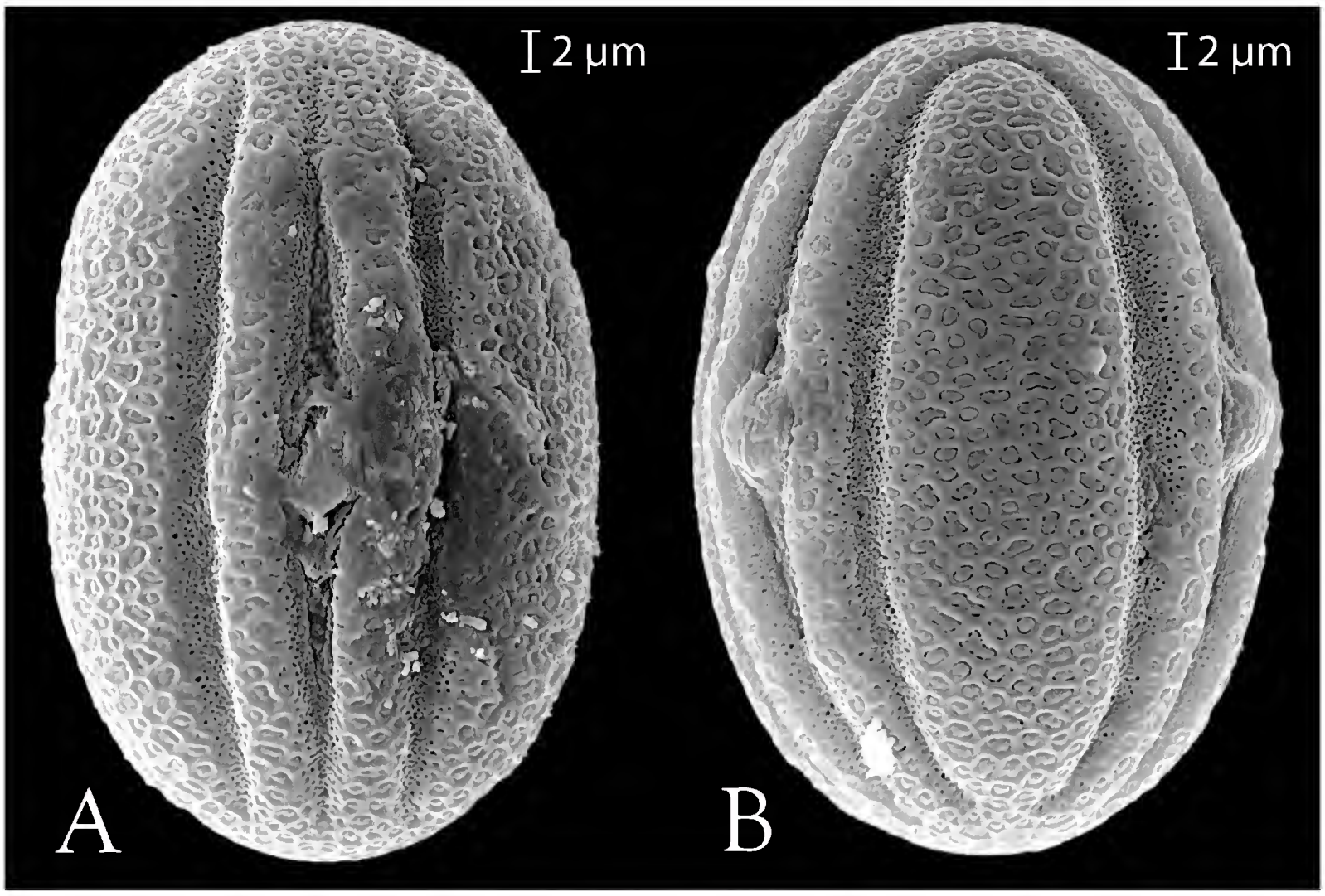

FIGURE 3. Pollen of *Anisotes tablensis* (*Rogers et al. 483*). A. Apertural view. B. Interapertural view.

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PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES

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Amphibians of the Philippines, Part I: Checklist of the Species

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The herpetological fauna of the Philippine Islands is high in diversity and endemism (Brown and Diesmos 2009; Brown et al. 2013; Diesmos et al. 2014), yet faces threats such as habitat modification and loss, natural catastrophes (i.e., Typhoon Haiyan), invasive species, hunting for food or the pet trade, and the spread of chytrid fungus (Sodhi et al. 2004; Diesmos et al. 2006, 2012; Rowley et al. 2010; Brown et al. 2012). New species descriptions have been steadily rising since the early 1990s due to increased sampling, an awareness of species boundaries based on phylogenetic studies, and changes in our understanding of what defines a species (Figure 1 [p. 489]; Brown et al. 2001, 2008, 2013; Diesmos et al. 2002, 2012; Diesmos and Brown 2011; Brown and Stuart 2012). Developing a complete species list for amphibians is essential for conservation planning and informed management decisions. Previous lists (Brown 2007; Diesmos and Brown 2011; Diesmos et al. 2014) were derived in part from working compendiums, developed and distributed separately by RIC and ACD; these simple lists focused on taxonomic and conservation status of the included species, respectively, but were of limited use for other purposes.

Herein we provide a comprehensive checklist of Philippine amphibian diversity, created by searching worldwide museum databases for Philippines taxa, augmented with a thorough review of recently published new species descriptions. Museum records from 33 museums were obtained either through direct contact with museum websites and personnel or through database portals such

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as VertNET (<*http://vertnet.org*>) and Global Biodiversity Information Facility (GBIF, <*http://www.gbif.org*>). In total, we reviewed 43,222 specimen records.

In this checklist, information associated with each species has the following sequence: (1) the original source, (2) a non-exhaustive, representative synonymy (see also comments below), (3) the type locality as reported in the authoritative description and holotype catalog number, if known, and (4) distribution within the Philippines and identification of endemism. Distributions are given as island names only, with species considered present on each reported island. Full citations for all authoritative descriptions are provided in the Literature Cited section.

Distribution dot maps were created based on a total of 4,015 unique localities from the georeferenced museum records described above using ArcMap v.10.3.1 (Figures 2–30, 43). Due to lack of precise locality data or coordinates for some museum records, a proportion of known species occurences may not have been included in the dot maps. Topographic maps were created in ArcMap v.10.3.1 using the digital elevation model (DEM) layers based on NASA's Shuttle Radar Topographic Mission (SRTM). The SRTM data are available for free at approximately 90 meters resolution (3 arc-second projections; Reuter et al. 2007; CIAT-CSI SRTM 2015). Representative photos of most currently recognized species have also been provided (Figures 31–42, 44).

Although every effort was made to provide detailed taxon-specific synonyms for every species, the emphasis of this study was to provide an updated documentation and concise overview of the current diversity of amphibians in the Philippines. We direct readers to additional primary sources and amphibian biodiversity information products for original species descriptions and complete synonymies: Amphibian Species of the World (<*http://research.amnh.org/vz/herpetology/amphibia/*>; Frost 2015) and AmphibiaWeb (<*http://amphibiaweb.org*>; Amphibia Web 2015).

Museum designation symbolic codes follow Sabaj Pérez (2014): British Museum of Natural History (BMNH); California Academy of Sciences (CAS); California Academy of Sciences, Stanford University (CAS-SU); Carnegie Museum (CM); Field Museum of Natural History (FMNH); Museum of Comparative Zoology, Harvard University (MCZ), Museum National d'Histoire Naturelle (MNHNP), Museo Civico di Storia Naturale (MSNG), Naturhistorisches Museum (NHMW of NMW); National Museum of the Philipines (formerly Philippine National Museum; NMPH or PNM); Naturalis Biodiversity Center (RMNH); Senkenberg Forschungsinstitut und Naturmuseum (SMF); National Museum of Natural History, Smithsonian Institution (USNM); Museum für Naturkunde (ZMB).

Amphibians of the Philippines, Part II, which will include identification keys for the amphibian fauna, will be issued in 2016.

Class Amphibia, Order Anura
Family Bombinatoridae

***Barbourula busuangensis* Taylor and Noble 1924**

Barbourula busuangensis Taylor and Noble 1924

Type locality and holotype specimen: Philippines, "small stream in the southern part of Busuanga [Island], the largest island of the Calamianes group" (Taylor and Noble 1924) (MCZ 14004).

Philippine distribution: Balabac, Busuanga, Culion, Palawan (Endemic).

Figures 3 and 31.

Family Bufonidae

***Ansonia mcgregori* (Taylor 1922)**

Bufo mcgregori Taylor 1922, 1944; Slevin and Leviton 1956; Van Tuijl 1995

Ansonia muelleri Inger 1954

Ansonia mcgregori, Inger 1960

Type locality and holotype specimen: Philippines, Mindanao, Zamboanga, near Pasonanka (= Pasonanca) (CAS 61839).

Philippine distribution: Mindanao (Endemic).

Figures 3 and 31.

***Ansonia muelleri* (Boulenger 1887)**

Bufo muelleri Boulenger 1887; Frost 1985

Ansonia muelleri, Inger 1954; Alcala and Brown 1998

Type locality and holotype specimen: Philippines, Mindanao (BMNH 1947.2.20.57).

Philippine distribution: Dinagat, Mindanao (Endemic).

Figures 3 and 31.

***Ingerophrynus philippinicus* (Boulenger 1887)**

Bufo philippinicus Boulenger 1887; Iskandar 1998; Inger, 1999

Bufo divergens Mocquard 1890

Bufo biporcatus philippinicus, Inger 1954; Alcala and Brown 1998

Ingerophrynus philippinicus, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006

Type locality and holotype specimen: Philippines, Palawan, Puerta Princesa (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Balabac, Busuanga, Culion, Dumaran, Palawan (Endemic).

Figures 3 and 31.

***Pelophryne albotaeniata* Barbour 1938**

Pelophryne albotaeniata Barbour 1938

Pelophryne albotaeniata albotaeniata, Inger 1954

Type locality and holotype specimen: Philippines, Palawan, Thumb Peak (4,500 ft. elev.) (MCZ 23291).

Philippine distribution: Palawan (Endemic).

Figure 4.

***Pelophryne brevipes* (Peters 1867)**

Hylaplesia brevipes Peters 1867
Bufo brevipes, Cope 1867; Boulenger 1882
Pelophryne brevipes, Barbour 1938

Type locality and holotype specimen: Philippines, Mindanao, Zamboanga (NMW 16554, syntype).
Philippine distribution: Basilan, Mindanao (Endemic).
Figures 4 and 31.

***Pelophryne lighti* (Taylor 1920)**

Nectophryne lighti Taylor 1920
Pelophryne lighti, Barbour 1938; Inger 1960
Pelophryne brevipes, Inger 1954
Pelophryne albotaeniata lighti, Inger 1954

Type locality and holotype specimen: Philippines, Mindanao, Agusan Province, Bunawan (E. H. Taylor Collection No. 189, destroyed).
Philippine distribution: Bohol, Leyte, Mindanao, Samar (Endemic).
Figures 4 and 31.

***Rhinella marina* (Linnaeus 1758)**

Rana marina Linnaeus 1758
Bufo brasiliensis Laurenti 1768
Rana gigas Walbaum 1784
Rana humeris-armata Lacépède 1788
Rana humeris-armata, Bonnaterre 1789
Bufo marinus Schneider 1799; Gravenhorst 1829
Bufo agua Sonnini de Manoncourt and Latreille 1801
Rana brasiliana Shaw 1802
Bufo horridus Daudin 1802
Bufo humeralis Daudin 1803
Bombinator maculates Merrem 1820
Rana maxima Merrem 1820
Bombinator horridus Merrem 1820
Bufo maculiventris Spix 1824
Bufo lazarus Spix 1824
Bufo albicans Spix 1824
Bufo horribilis Weigmann 1833
Docidophryne agua Fitzinger 1843
Docidophryne Lazarus Fitzinger 1861
Phrynoidis agua Cope 1862
Bufo marinus var. *horribilis* Peters 1873; Lynch and Fugler 1965
Bufo marinus var. *fluminensis* Jiménez de la Espada 1875
Bufo marinus var. *napensis* Jiménez de la Espada 1875
Bufo pithecodactylus Werner 1899
Bufo marinis, Barbour and Noble 1920
Bufo marinus marinus, Schmidt 1932
Bufo angustipes Taylor and Smith 1945
Bufo pythecodactylus Rivero 1961

Chaunus marinus, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Rhinella marina, Chaparro, Pramuk, and Gluesenkamp 2007
Rhinella marinus, Pramuk, Robertson, Sites, and Noonan 2008

Type locality and holotype specimen: America (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Alabat, Bohol, Calayan, Catanduanes, Cebu, Cocomo, Dinagat, Gigantes Norte, Leyte, Lubang, Luzon, Marinduque, Masbate, Mindanao, Mindoro, Negros, Palawan, Panay, Polillo, Romblon Island Group, Sicogon, Samar, Ticao, Verde (Introduced; Diesmos et al. 2006).

Figures 4 and 31.

Family Ceratobatrachidae

***Alcalus mariae* (Inger 1954)**

Micrixalus mariae Inger 1954
Ingerana (*Ingerana*) *mariae*, Dubois 1987 "1986"
Taylorana mariae, Fei, Ye, and Jiang 2010
Alcalus mariae, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Palawan, Mantalingajan Range, south slope of Mount Balabag (FMNH 51360).

Philippine distribution: Palawan (Endemic).

Figures 12 and 35.

***Platymantis banahao* Brown, Alcala, Diesmos, and Alcala 1997**

Platymantis banahao Brown, Alcala, Diesmos, and Alcala 1997
Platymantis (*Lahatnanguri*) *banahao*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Quezon Province, NE slope of Mt. Banahao (1,100 m elev.) (CAS 201208).

Philippine distribution: Luzon (Endemic).

Figures 5 and 32.

***Platymantis bayani* Siler, Alcala, Diesmos, and Brown 2009**

Platymantis bayani Siler, Alcala, Diesmos, and Brown 2009
Platymantis (*Tahananpuno*) *banahao*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Samar, Eastern Samar Province, Municipality of Taft, Barangay San Rafael, Taft Forest (11.80255°N, 125.29276°E; WGS84; 140 m elev.) (PNM 9501).

Philippine distribution: Samar (Endemic).

Figures 5 and 32.

***Platymantis biak* Siler, Diesmos, Likem, Diesmos, and Brown 2010**

Platymantis biak Siler, Diesmos, Linkem, Diesmos, and Brown 2010
Platymantis (*Lahatnanguri*) *biak*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Bulacan Province, Municipality of San

Miguel and Doña Remedios Trinidad, Barangay Biak na Bato (15.1084°N, 121.0724°E; 190 m elev.) (PNM 9679).

Philippine distribution: Luzon (Endemic).

Figure 5.

***Platymantis cagayanensis* Brown, Alcala, and Diesmos 1999**

Platymantis cagayanensis Brown, Alcala, and Diesmos 1999

Platymantis (*Lupacolus*) *cagayanensis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Cagayan Province, Central Cordillena, Santa Praxedes Town, Taggat Forest Reserve (50–100 m elev.) (PNM 6691).

Philippine distribution: Luzon, Palaui (Endemic).

Figures 5 and 32.

***Platymantis cornutus* (Taylor 1922)**

Cornufer cornutus Taylor 1922

Platymantis cornutus, Zweifel 1967

Platymantis cornuta, Günther 1999

Platymantis (*Lahatnanguri*) *cornutus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Mountain Province, Kalinga, Balbalan (CAS 61476).

Philippine distribution: Luzon (Endemic).

Figures 6 and 32.

***Platymantis corrugatus* (Duméril 1853)**

Hylodes corrugatus Duméril 1853

Platymantis plicifera Günther 1858

Hylodes (*Halophilus*) *corrugatus*, Cope 1862

Halophila (*Platymantis*) *plicifera*, Peters 1863

Platymantis corrugata, Boulenger 1918; Günther 1999

Rana (*Platymantis*) *rugata* Van Kampen 1923

Platymantis corrugatus corrugatus, Loveridge 1948

Platymantis (*Tagomukhus*) *corrugatus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Java (in error, according to Inger 1954) (MNHNP 4884).

Philippine distribution: Bohol, Cagraray, Camiguin Sur, Camotes Island Group, Catanduanes, Cebu, Dinagat, Leyte, Luzon, Mindanao, Mindoro, Negros, Panay, Polillo, Ponson, Poro, Rapu-Rapu, Samar, Sicogon, Siquijor (Endemic).

Figures 6 and 32.

***Platymantis diesmosi* Brown and Gonzalez 2007**

Platymantis diesmosi Brown and Gonzalez 2007

Platymantis (*Tahananpuno*) *diesmosi*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Albay Province, Municipality of Tiwi, Barangay Banshaw, Sitio Purok 7, area known locally as 'Tamagong,' NW slope of Mt. (13.436667°N, 123.59°E; WGS84; 950 m elev.) (PNM 8499).

Philippine distribution: Luzon (Endemic).
Figures 6 and 32.

***Platymantis dorsalis* (Duméril 1853)**

Cornufer dorsalis Duméril 1853
Hylodes (*Halophilus*) *dorsalis*, Cope 1862
Halophila jagorii Peters 1863
Halophila platydactyla Günther 1864
Platymantis meyeri Günther 1873; Boulenger 1918
Cornufer jagorii, Boulenger 1882
Cornufer meyeri, Boulenger 1882; Inger 1954
Cornufer laticeps Taylor 1920
Rana (*Platymantis*) *dorsalis*, Guibé 1950 "1948"
Cornufer dorsalis, Brown and Inger 1964; Brown 1965
Platymantis dorsalis, Zweifel 1967; Brown and Alcala 1970a, b
Platymantis (*Lupacolus*) *dorsalis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Java (in error, according to Barbour 1923) (MNHNP 4880).
Philippine distribution: Alabat, Calagna-an, Cagraray, Catanduanes, Cebu, Danjugan, Leyte, Lubang, Luzon, Marinduque, Masbate, Negros, Pan de Azucar, Panay, Polillo, Rapu-Rapu, Sicogon, Ticao (Endemic).
Figures 6 and 32.

***Platymantis guentheri* (Boulenger 1882)**

Cornufer guentheri Boulenger 1882; Inger 1954
Cornufer worcesteri Stejneger 1905
Cornufer ingeri Brown and Alcala 1963
Platymantis ingeri, Zweifel 1967
Platymantis guentheri, Zweifel 1967
Platymantis (*Tahananpuno*) *guentheri*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Dinagat (BMNH 1947.2.31–34).
Philippine distribution: Biliran, Bohol, Dinagat, Leyte, Mindanao, Samar (Endemic).
Figures 7 and 33.

***Platymantis hazelae* (Taylor 1920)**

Philautus hazelae Taylor 1920
Cornufer rivularis Taylor 1922
Rhacophorus (*Philautus*) *hazelae*, Ahl 1931
Platymantis hazelae, Inger 1954; Zweifel 1967; Brown and Alcala 1970a, b
Cornufer hazelae, Inger 1954; Brown 1965
Platymantis (*Tirahanulap*) *hazelae*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, central northern Negros, Canlaon Volcano (ca. 1,000 m elev.) (CM 3427).
Philippine distribution: Negros, Masbate (Endemic).
Figures 7 and 33.

***Platymantis indeprensus* Brown, Alcala, and Diesmos 1999**

Platymantis indeprensus Brown, Alcala, and Diesmos 1999
Platymantis indeprensa, Günther 1999
Platymantis (*Lupacolus*) *indeprensus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Mt. Banahao (1,080 m elev.) (CAS 201196)
Philippine distribution: Luzon (Endemic).
Figure 7.

***Platymantis insulatus* Brown and Alcala 1970**

Platymantis insulatus Brown and Alcala 1970a, b
Platymantis insulata, Günther 1999
Platymantis (*Lahatnanguri*) *insulatus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Gigante Sur Island (CAS 117441).
Philippine distribution: Gigante Norte, Gigante Sur (Endemic).
Figures 7 and 33.

***Platymantis isarog* Brown, Brown, Alcala, and Frost 1997**

Platymantis isarog Brown, Brown, Alcala, and Frost 1997
Platymantis reticulates Brown, Brown, and Alcala 1997
Platymantis (*Tirahanulap*) *isarog*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, southeastern Luzon, Camarines Peninsula, Mt. Isarog (1,200–1,300 m elev.) (CAS 197218).
Philippine distribution: Luzon (Endemic).
Figures 8 and 33.

***Platymantis lawtoni* Brown and Alcala 1974**

Platymantis lawtoni Brown and Alcala 1974
Platymantis (*Tirahanulap*) *lawtoni*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Tablas, Dubduban (ca. 800 ft. elev.) (CAS 135732)
Philippine distribution: Romblon Island Group (Endemic).
Figures 8 and 33.

***Platymantis levigatus* Brown and Alcala 1974**

Platymantis levigatus Brown and Alcala 1974
Platymantis levigata, Günther 1999
Platymantis (*Lahatnanguri*) *levigatus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Tablas, San Agustin, Dubduban (ca. 650 ft. elev.) (CAS 136097).
Philippine distribution: Romblon Island Group (Endemic).
Figures 8 and 33.

***Platymantis luzonensis* Brown, Alcala, Diesmos, and Alcala 1997**

Cornifer guentheri, Inger 1954
Platymantis guentheri, Brown and Alcala 1970
Platymantis luzonensis Brown, Alcala, Diesmos, and Alcala 1997
Platymantis (*Tahananpuno*) *luzonensis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Laguna Province, Mt. Makiling (ca. 600 m elev.) (CAS 196368).
Philippine distribution: Luzon, Polillo (Endemic).
Figures 8 and 33.

***Platymantis mimulus* Brown, Alcala, and Diesmos 1999**

Platymantis mimulus Brown, Alcala, and Diesmos 1997
Platymantis mimula, Günther 1999
Platymantis (*Lupacolus*) *mimulus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Laguna Province, Los Banos, Mt. Maquiling (ca. 400 m elev.) (CAS 136097).
Philippine distribution: Luzon (Endemic).
Figure 9.

***Platymantis montanus* (Taylor 1922)**

Cornufer montanus Taylor 1922
Platymantis montanus, Zweifel 1967
Platymantis montana, Günther 1999
Platymantis (*Tirahanulap*) *montanus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Laguna Province, Mount Banahao (ca. 1,500 m elev.) (CAS 61179).
Philippine distribution: Luzon (Endemic).
Figures 9 and 33.

***Platymantis naomii* Alcala, Brown, and Diesmos 1998**

Platymantis naomii Alcala, Brown, and Diesmos 1998
Platymantis naomiae, Iskandar and Colijn 2000
Platymantis (*Lupacolus*) *naomii*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, southeast slope of Mt. Banahao on Tayabas side (ca. 1,400 m elev.) (CAS 204746).
Philippine distribution: Luzon (Endemic).
Figure 9.

***Platymantis negrosensis* Brown, Alcala, Diesmos, and Alcala 1997**

Platymantis negrosensis Brown, Alcala, Diesmos, and Alcala 1997
Platymantis (*Tahananpuno*) *negrosensis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Negros, Negros Oriental Province, Lake Balinsasayao (CAS 137416).
Philippine distribution: Negros, Panay (Endemic).
Figures 9 and 34.

***Platymantis paengi* Siler, Linkem, Diesmos, and Alcala 2007**

Platymantis paengi Siler, Linkem, Diesmos, and Alcala 2007

Platymantis (*Lupacolus*) *paengi*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Panay, Antique Province, Municipality of Pandan, Barangay Duyong, in an area known locally as 'Mt. Lihidan' (11.41465°N, 122.10465°E; WGS84; 180 m elev.) (PNM 9239).

Philippine distribution: Panay (Endemic).

Figures 10 and 34.

***Platymantis panayensis* Brown, Brown, and Alcala 1997**

Platymantis panayensis Brown, Brown, and Alcala 1997

Platymantis (*Tirahanulap*) *panayensis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Panay, Aklan Province, Libacao, northwest ridge approach to Mt. Madja-as (ca. 1,410 m elev.) (PNM 2495).

Philippine distribution: Panay (Endemic).

Figure 10.

***Platymantis polillensis* (Taylor 1922)**

Philautus polillensis Taylor 1922

Rhacophorus polillensis, Ahl 1931

Cornufer polillensis, Inger 1954

Platymantis polillensis, Zweifel 1967

Platymantis polilloensis, Alcala 1986; Brown, Brown, and Alcala 1997

Platymantis (*Tirahanulap*) *polillensis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Polillo, near the southern end of island (CAS 62250).

Philippine distribution: Luzon, Polillo (Endemic).

Figures 10 and 34.

***Platymantis pseudodorsalis* Brown, Alcala, and Diesmos 1999**

Platymantis pseudodorsalis Brown, Alcala, and Diesmos 1999

Platymantis (*Lupacolus*) *pseudodorsalis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Mt. Banahao (PNM 6689).

Philippine distribution: Luzon (Endemic).

Figure 10.

***Platymantis pygmaeus* Alcala, Brown, and Diesmos 1998**

Platymantis pygmaeus Alcala, Brown, and Diesmos 1998

Platymantis pygmaea, Günther 1999

Platymantis (*Lahatnanguri*) *pygmaeus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Isabela Province, Municipality of Palanan, Barangay Didian, Sitio Natapdukan, Northern Sierra Madre Natural Park (16.9655°N, 122.4038°E; WGS84; 55–65 m elev.) (PNM 6255).

Philippine distribution: Luzon, Sibuyan (Endemic).
Figures 11 and 34.

***Platymantis quezoni* Brown, De Layola, Lorenzo, Diesmos, and Diesmos 2015**

Platymantis (*Lupacolus*) *quezoni* Brown, De Layola, Lorenzo, Diesmos, and Diesmos 2015

Platymantis "sp. 27", Brown, Siler, Richards, Diesmos, and Cannatella, 2015

Type locality and holotype specimen: Philippines, Luzon, Quezon Province, Municipality of Atimonan, Barangay Malinao Ilaya, Quezon Protected Landscape (13.989°N, 121.818°E; WGS84; 275 m elev.) (PNM 9817, formerly KU 339542).
Philippine distribution: Luzon (Endemic).
Figures 43 and 44.

***Platymantis rabori* Brown, Alcala, Diesmos, and Alcala 1997**

Platymantis rabori Brown, Alcala, Diesmos, and Alcala 1997

Platymantis (*Tahananpuno*) *rabori*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Bohol, Sierra Bullones, Cantaub (CAS 136889).
Philippine distribution: Bohol, Leyte, Mindanao, Samar (Endemic).
Figures 11 and 34.

***Platymantis sierramadrensis* Brown, Alcala, Ong, and Diesmos 1999**

Platymantis sierramadrensis Brown, Alcala, Ong, and Diesmos 1999

Platymantis (*Tirahanulap*) *sierramadrensis*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Quezon Province, Municipality of General Nakar, Barangay Umiray, at Sitio Mapidjas (PNM 6465).
Philippine distribution: Luzon (Endemic).
Figures 11 and 34.

***Platymantis spelaeus* Brown and Alcala 1982**

Platymantis spelaeus Brown and Alcala 1982

Platymantis spelaea, Günther 1999

Platymantis (*Lupacolus*) *spelaeus*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Negros, southern Negros Oriental, Basay, Tiyabanan Barrio, in limestone cave (CAS 153469).
Philippine distribution: Negros (Endemic).
Figures 11 and 34.

***Platymantis subterrestris* (Taylor 1922)**

Cornufer subterrestris Taylor 1922; Inger 1954

Platymantis subterrestris, Zweifel 1967; Brown and Alcala 1970

Platymantis (*Tirahanulap*) *subterrestris*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Mountain Province, near kilometer 101 on the Mountain Trail (CAS 61518).
Philippine distribution: Luzon (Endemic).
Figures 12 and 34.

***Platymantis taylori* (Brown, Alcala, and Diesmos 1999)**

Platymantis taylori Brown, Alcala, and Diesmos 1999
Platymantis (*Lupacolus*) *taylori*, Brown, Siler, Richards, Diesmos, and Cannatella 2015

Type locality and holotype specimen: Philippines, Luzon, Province of Isabela, Municipality of Palanan, Barangay Didian, eastern Sierra Madre Mountains in Sitio Natapdukan (PNM 6884).

Philippine distribution: Luzon (Endemic).

Figures 12 and 35.

Family Dicroglossidae

***Fejervarya moodiei* (Taylor 1920)**

Rana cancrivora Gravenhorst 1829
Rana tigrina angustopalmata Van Kampen 1907; Barbour 1912
Rana tigrina var. *cancrivora*, Boulenger 1918
Rana cancrivora, Annandale 1918
Rana (*Rana*) *crancrivora*, Boulenger 1920
Rana moodiei, Taylor 1920
Rana cancrivora cancrivora, Dunn 1928; Inger 1954
Rana cancrivora raja Smith 1930
Dicroglossus cancrivorus, Deckert 1938
Rana raja, Taylor 1962
Rana (*Euphlyctis*) *cancrivora*, Dubois 1981
Euphlyctis cancrivora, Poynton and Broadley 1985
Limnonectes (*Hoplobatrachus*) *cancrivorus*, Dubois 1987 "1986"
Limnonectes (*Hoplobatrachus*) *moodiei*, Dubois 1987 "1986"
Limnonectes (*Hoplobatrachus*) *raja*, Dubois 1987 "1986"
Limnonectes (*Fejervarya*) *raja*, Dubois 1992
Limnonectes (*Fejervarya*) *cancrivorus*, Dubois 1992
Fejervarya raja, Iskandar 1998
Fejervarya cancrivora, Iskandar 1998
Fejervarya moodiei, Dubois and Ohler 2000

Type locality and holotype specimen: Indonesia, Java (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Apo, Bohol, Boracay, Busuanga, Cagraray, Calagna-an, Caluya, Camiguin Sur, Cebu, Clara, Cuyo, Dumaran, Dinagat, Gigantes Norte, Gigantes Sur, Guimaras, Inampulugan, Jau, Lapinin Chico, Lapinig Grande, Leyte, Lubang, Luzon, Mactan, Marinduque, Masbate, Mindanao, Mindoro, Negros, Pacijan, Palawan, Pan de Azucar, Panay, Polillo, Ponson, Rapu-Rapu, Romblon Island Group, Sicogon, Sulu Archipelago, Ticao, Tintiman, Verde (Non-endemic).

Figures 12 and 34.

***Fejervarya vittigera* (Wiegmann 1834)**

Rana vittigera Wiegmann 1834
Rana limnocharis vittigera, Inger 1954
Rana (*Fejervarya*) *vittigera*, Dubois 1984
Euphlyctis limnocharis vittigera, Poynton and Broadley 1985
Limnonectes (*Fejervarya*) *vittiger*, Dubois 1987 "1986"

Rana limnocharis, Alcala and Brown 1998
Fejervarya vittigera, Iskandar 1998

Type locality and holotype specimen: Philippines, southern Luzon, Laguna Bay (CAS 61636).

Philippine distribution: Bohol, Cagraray, Caluya, Camiguin Sur, Cebu, Cocomo, Dinagat, Guimaras, Leyte, Lubang, Luzon, Marinduque, Masbate, Mindanao, Mindoro, Negros, Palawan, Pan de Azucar, Panay, Polillo, Romblon Island Group (Endemic).

Figures 13 and 35.

***Hoplobatrachus rugulosus* (Wiegmann 1834)**

Rana chinensis Osbeck 1765
Rana rugulosa Wiegmann 1834; Annandale 1918; Alcala and Brown 1998
Rana tigrina pantherina Steindachner 1867; Boulenger 1920; Taylor and Elbel 1958
Hydrostentor pantherinus, Steindachner 1867
Rana tigrina, Flower 1899
Rana esculenta chinensis, Wolterstorff 1906
Rana burkilli Annandale 1910
Rana tigerina var. *burkilli*, Boulenger 1918
Rana tigrina rugulosa, Smith 1930; Fang and Chang 1931
Rana (*Euphlyctis*) *rugulosa*, Dubois 1981
Euphlyctis tigerina rugulosa, Poynton and Broadley 1985
Limnonectes (*Hoplobatrachus*) *rugulosus*, Dubois 1987 "1986"
Tigrina rugulosa, Fei, Ye, and Huang 1990
Hoplobatrachus rugulosus, Dubois 1992
Hoplobatrachus chinensis, Ohler, Swan, and Daltry, 2002

Type locality and holotype specimen: China, vicinity of Canton (ZMB 3721).

Philippine distribution: Caluya, Luzon, Masbate, Mindoro, Panay (Introduced; Diesmos et al. 2006).

Figures 13 and 35.

***Limnonectes acanthi* (Taylor 1923)**

Rana macrodon blythii (part) Boulenger 1920
Rana acanthi Taylor 1923; Taylor and Elbel 1958
Rana macrodon acanthi, Inger 1954; Brown and Alcala 1955
Rana magna acanthi, Inger 1958
Limnonectes (*Limnonectes*) *acanthi*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Calamian Islands, Busuanga Island (CAS 32577).

Philippine distribution: Balabac, Busuanga, Culion, Mindoro, Moro, Palawan (Endemic).

Figures 13 and 35.

***Limnonectes diuatus* (Brown and Alcala 1977)**

Rana diuata Brown and Alcala 1977
Limnonectes (*Limnonectes*) *diuatus*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Mindanao, Agusan del Norte Province, Cabadbaran, Diuata Mountains, south side of Mt. Hilong-hilong, Taguibo River (ca. 1,000 m elev.) (CAS 133500).

Philippine distribution: Mindanao (Endemic).

Figure 13.

***Limnonectes ferneri* Siler, McVay, Diesmos, and Brown 2009**

Limnonectes ferneri Siler, McVay, Diesmos, and Brown 2009

Type locality and holotype specimen: Philippines, Mindanao, Davao Del Norte Province, Municipality of Monkayo, Mt. Pasian in the Simulaw River Drainage, 2.3 km N, 1.0 km E of peak (7.971183°N, 126.297367°E; WGS84; 1,409 m elev.) (PNM 9506).

Philippine distribution: Mindanao (Endemic).

Figure 14.

***Limnonectes leytensis* (Boettger 1893)**

Hylarana mindanensis Girard 1853
Rana mindanensis Boettger 1886
Rana leytensis, Boettger 1893; Inger 1966
Rana microdisca Boulenger 1920
Rana microdisca leytensis, Inger 1954; Mertens 1967
Limnonectes (*Limnonectes*) *leytensis*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Mindanao, unknown caldera (SMF 4931).

Philippine distribution: Basilan, Bohol, Camiguin Sur, Cebu, Dinagat, Leyte, Mindanao, Negros, Romblon Island Group, Samar, Sulu Archipelago (Endemic).

Figures 14 and 35.

***Limnonectes macrocephalus* (Inger 1954)**

Rana macrodon Boulenger 1882 (partim)
Rana magna Stejneger 1909 (partim)
Rana macrodon macrocephala Inger 1954
Rana magna macrocephala, Inger 1958
Rana (*Euphlyctis*) *magna macrocephala*, Dubois 1981
Euphlyctis magna macrocephala, Poynton and Broadley 1985
Limnonectes (*Limnonectes*) *macrocephalus*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Luzon, Tayabas Province, Sampaloc (FMNH 40519).

Philippine distribution: Alabat, Cagraray, Catanduanes, Luzon, Marinduque, Masbate, Polillo, Rapu-Rapu (Endemic).

Figures 14 and 35.

***Limnonectes magnus* (Stejneger 1910)**

Rana macrodon Boulenger 1882 (partim)
Rana magna Stejneger 1910; Boulenger 1920
Rana modesta Roux 1918
Rana macrodon blythii Boulenger, 1920 (partim)
Rana modesta magna, Smith 1927
Rana macrodon magna, Inger 1954 (partim)
Rana magna magna, Inger 1958 (partim)
Rana (*Euphlyctis*) *magna*, Dubois 1981 (partim)
Euphlyctis magna, Poynton and Broadley 1985 (partim)
Limnonectes (*Limnonectes*) *magnus*, Dubois 1987 "1986" (partim)

Type locality and holotype specimen: Philippines, Mindanao, Mount Apo, between Todaya and camp (4,000–6,000 ft. elev.) (USNM 35231).

Philippine distribution: Basilan, Biliran, Bohol, Camiguin Sur, Dinagat, Leyte, Mindanao, Samar (Endemic).
Figures 14 and 36.

***Limnonectes micrixalus* (Taylor 1923)**

Rana micrixalus Taylor 1923; Inger 1954; Dubois 1987 "1986"
Limnonectes micrixalus, Slevin and Leviton 1956

Type locality and holotype specimen: Philippines, Basilan, Abungabung (CAS 60143).
Philippine distribution: Basilan, Mindanao (Endemic).
Figure 15.

***Limnonectes palavanensis* (Boulenger 1894)**

Rana palavanensis Boulenger 1894; Boulenger 1920; Inger and Voris 1988
Rana microdisca palavanensis, Inger 1954
Rana (*Euphlyctis*) *microdisca palavanensis*, Dubois 1981
Euphlyctis palavanensis, Poynton and Broadley 1985
Limnonectes (*Limnonectes*) *palavanensis*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Palawan Island (Status and whereabouts of holotype unknown; not traced).
Philippine distribution: Palawan (Non-endemic).
Figures 15 and 36.

***Limnonectes parvus* (Taylor 1920)**

Rana parva Taylor 1920; Inger 1954
Rana microdisca parva Inger 1966
Rana (*Euphlyctis*) *microdisca parva* Dubois 1981
Euphlyctis microdisca parva Poynton and Broadley 1985
Limnonectes (*Limnonectes*) *parvus*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Mindanao, Agusan Province, Bunawan (CM 3241).
Philippine distribution: Basilan, Mindanao (Endemic).
Figures 15 and 36.

***Limnonectes visayanus* (Inger 1954)**

Rana macrodon Boulenger 1882
Rana macrodon blythii (part) Boulenger 1920
Rana magna Taylor 1923; Brown and Alcala 1970
Rana macrodon visayanus, Inger 1954
Rana magna visayanus, Inger 1958
Limnonectes (*Limnonectes*) *visayanus*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Siquijor Island (FMNH 61636).
Philippine distribution: Bohol, Calagna-an, Cebu, Guimaras, Masbate, Negros, Panay, Poro, Romblon Island Group, Sicogon, Siquijor, Ticao (Endemic).
Figures 15 and 36.

***Limnonectes woodworthi* (Taylor 1923)**

Rana woodworthi Taylor 1923
Limnonectes (*Limnonectes*) *woodworthi*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, Luzon, Laguna Province, near Los Baños (CAS 61000).
Philippine distribution: Camiguin Norte, Catanduanes, Luzon, Polillo (Endemic).
Figures 16 and 36.

***Occidozyga diminutiva* (Taylor 1922)**

Micrixalus diminutiva Taylor 1922; Alcala and Brown 1998
Staurois diminutives, Forcart 1946
Ooeidozyga diminutives, Inger 1954
Occidozyga diminutiva, Dubois 1981
Phrynoglossus diminutives, Dubois 1987 "1986"
Phrynoglossus diminutiva, Inger 1999; Fei, Ye, and Jiang 2010

Type locality and holotype specimen: Philippines, Mindanao, Zamboanga, "near Pasananka" (CAS 61842).
Philippine distribution: Basilan, Mindanao, Sulu Archipelago (Endemic).
Figures 16 and 36.

***Occidozyga laevis* (Günther 1858)**

Oxyglossus laevis Günther 1858; Bourret 1927
Phrynoglossus laevis, Peters 1867
Oxyglossis laevis, Smith 1916
Oxydozyga laevis, Mertens 1927
Ooeidozyga laevis, Smith 1927
Oxydozyga laevis laevis, Mertens 1930
Phrynoglossus laevis laevis, Mertens 1934
Ooeidozyga laevis laevis, Inger 1954
Occidozyga laevis, Dubois 1981; Alcala and Brown 1998

Type locality and holotype specimen: Philippines (Status and whereabouts of holotype unknown; not traced).
Philippine distribution: Alabat, Balabac, Bohol, Bonoon, Busuanga, Cagraray, Calagna-an, Calauit, Camiguin Sur, Catanduanes, Cebu, Coron, Dinagat, Guimaras, Inampulugan, Leyte, Lubang, Luzon, Marinduque, Masbate, Mindanao, Mindoro, Negros, Palawan, Panay, Polillo, Romblon Island Group, Samar, Sicogon, Sulu Archipelago (Non-endemic).
Figures 16 and 36.

Family Eleutherodactylidae

***Eleutherodactylus planirostris* (Cope, 1862)**

Hylodes planirostris Cope 1862
Eleutherodactylus planirostris, Stejneger 1904
Eleutherodactylus ricordii planirostris, Shreve 1945
Eleutherodactylus planirostris planirostris, Schwartz 1965
Eleutherodactylus (*Euhyas*) *planirostris*, Hedges 1989; Heinicke, Duellman, and Hedges 2007
Euhyas planirostris, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, Green, and Wheeler 2006

Type locality and holotype specimen: New Providence Island, Bahamas (25.024936°N, 77.467209°W) (Peabody Essex Museum, presumed lost).

Philippine distribution: Luzon, Mindanao (Introduced; Olson et al. 2014; Sy et al. 2015).
Figure 16.

Family Megophryidae

***Leptobrachium lumadorum* Brown, Siler, Diesmos, and Alcala 2009**

Leptobrachium lumadorum Brown, Siler, Diesmos, and Alcala 2010 "2009"

Type locality and holotype specimen: Philippines, Mindanao, Zamboanga Del Sur Province, Zamboanga City, Barangay Baluno, Pasonanca Natural Park, Sitio km 24 (7.108°N, 122.0289°E; WGS84) (PNM 9561).

Philippine distribution: Basilan, Dinagat, Mindanao (Endemic).
Figures 17 and 36.

***Leptobrachium mangyanorum* Brown, Siler, Diesmos, and Alcala 2009**

Leptobrachium mangyanorum Brown, Siler, Diesmos, and Alcala 2010 "2009"

Type locality and holotype specimen: Philippines, Mindoro, Mindoro Oriental Province, Municipality of Victoria, Barangay Loyal, Sitio Panguisan, Panguisan River (13.150104°N, 121.200246°E; WGS84) (PNM 9559).

Philippine distribution: Mindoro, Semirara (Endemic).
Figures 17 and 37.

***Leptobrachium tagbanorum* Brown, Siler, Diesmos, and Alcala 2009**

Leptobrachium tagbanorum Brown, Siler, Diesmos, and Alcala 2010 "2009"

Type locality and holotype specimen: Philippines, Palawan, Palawan Province, Municipality of Puerto Princesa City, Barangay Irawan, Irawan Watershed (9.8333°N, 118.650°E; WGS84) (PNM 9560).

Philippine distribution: Palawan (Endemic).
Figures 17 and 37.

***Megophrys ligayae* Taylor 1920**

Megalophrys ligayae Taylor 1920; Inger 1999
Megophrys monticola ligayae, Inger 1954
Megophrys ligayae, Iskandar 1998

Type locality and holotype specimen: Philippines, northern Palawan (CM 3304, now CM 84521).
Philippine distribution: Balabac, Palawan (Endemic).
Figures 17 and 37.

***Megophrys stejnegeri* Taylor 1920**

Megophrys stejnegeri Taylor 1920
Megophrys monticola stejnegeri, Inger 1954
Megophrys steynegeri, Iskandar 1998

Type locality and holotype specimen: Philippines, Mindanao, Agusan Province, Bunawan (CM 3394).

Philippine distribution: Bohol, Dinagat, Leyte, Mindanao, Samar (Endemic).
Figures 18 and 37.

Family Microhylidae

***Chaperina fusca* Mocquard 1892**

Chaperina fusca Mocquard 1892; Inger, 1954
Microhyla leucostigma Boulenger 1899
Chaperina beyeri Taylor 1920
Nectophryne picturata Smith 1921
Sphenophryne fusca, Van Kampen 1923; Nieden, 1926
Sphenophryne beyeri Van Kampen 1923
Sphenophryne leucostigma Smith 1925

Type locality and holotype specimen: Borneo, Sintang (MNHNP 91-49).
Philippine distribution: Basilan, Mindanao, Palawan, Sulu Archipelago (Non-endemic).
Figures 18 and 37.

***Kalophrynus sinensis* Peters 1867**

Calophrynus pleurostigma var. *sinensis* Peters 1867
Kalophrynus sinensis, Zug 2015

Type locality and holotype specimen: "Hongkong" [in error] (ZMB 5696). (NB: See Frost, 2015, for additional details of the complex synonymy associated with this nominal species.)
Philippine distribution: Basilan, Bohol, Camiguin Sur, Culion, Dinagat, Leyte, Mindanao, Samar (Non-endemic).
Figures 18 and 37.

***Kaloula baleata* (Müller *in* Van Oort and Müller 1836)**

Bombinator baleatus Müller *in* Van Oort and Müller 1836
Hyladactylus baleatus, Tschudi 1838
Hylaedactylus baleatus, Duméril and Bibron 1841
Hylaedactylus balteatus, Lichtenstein and Martens 1856
Hylaedactylus baleatus var. *concatenata* Lichtenstein and Martens 1856
Hylaedactylus lividus Bleeker 1857
Bombinator (*Hylaedactylus*) *baleatus*, Schlegel 1858
Hylaedactylus celebensis Günther 1859 "1858"
Kaloula baleata, Günther 1859 "1858"; Barbour 1909
Callula baleata, Cope 1867; Boulenger 1882
Calohyla celebensis, Peters 1872
Plectropus baleatus, Knauer 1883
Kaloula baleata baleata, Inger 1954
Kaloula baleata ghoshi, Cherchi 1954

Type locality and holotype specimen: Indonesia, Java, Krawang (RMNH 22118).
Philippine distribution: Palawan (Non-endemic).
Figure 18.

***Kaloula conjuncta* (Peters 1863)**

Hylaedactylus (*Holonectes*) *conjunctus* Peters 1863
Callula conjuncta, Cope 1867
Kaloula conjucta, Taylor 1920
Kaloula negrosensis Taylor 1922
Kaloula conjuncta conjuncta, Inger 1954 (partim)

Kalaoula conjuncta negrosensis, Inger 1954 (partim)
Kaloula conjucta stickeli, Inger 1954
Kaloula conjuncta meridionalis, Inger 1954 (partim)
Type locality and holotype specimen: Philippines, Luzon Island (NMW 22888).
Philippine distribution: Alabat, Borocay, Caluya, Catanduanes, Cebu, Guimaras, Leyte, Luzon, Mindanao, Mindoro, Negros, Pacijan, Panay, Polillo, Poro, Romblon Island Group, Semirara, Siquijor, Sulu Archipelago (Endemic).
Figures 19 and 37.

***Kaloula kalingensis* Taylor, 1922**
Kaloula kalingensis Taylor 1922; Ross and Gonzales 1992
Kaloula baleata kalingensis, Inger 1954
Type locality and holotype specimen: Philippines, Luzon, Mountain Province, Kalinga, Balbalan (CAS 61462).
Philippine distribution: Luzon, Palaui (Endemic).
Figures 19 and 37.

***Kaloula kokacii* Ross and Gonzales 1992**
Kaloula kokacii Ross and Gonzales 1992
Type locality and holotype specimen: Philippines, Catanduanes, Gigmoto Municipality, from abaca near the Buadan River, Summit Boradan (8.5 km W and 1 km N of Gigmoto) (13.8°N, 124.316667°E; WGS84; 200–300 m elev.) (PNM 2043).
Philippine distribution: Catanduanes, Luzon (Endemic).
Figure 19.

***Kaloula picta* (Duméril and Bibron 1841)**
Plectropus pictus Duméril and Bibron 1841; Guibé 1950
Kaloula picta, Günther 1859; Parker 1934
Callula picta, Günther 1864
Type locality and holotype specimen: Philippines, Luzon, Manille (= Manila) (MNHNP 5027).
Philippine distribution: Alabat, Babuyan Island Group, Bohol, Caluya, Camiguin Sur, Catanduanes, Cebu, Cocomo, Cuyo, Dinagat, Guimaras, Lapinig Grande, Leyte, Lubang, Luzon, Mactan, Mindanao, Mindoro, Negros, Palawan, Panay, Polillo, Ponson, Rapu-Rapu, Samar, Semirara, Verde (Endemic).
Figures 19 and 38.

***Kaloula pulchra* Gray 1831**
Kaloula pulchra Gray 1831; Barbour 1909
Hylaedactylus bivittatus Cantor 1847; Boulenger 1882; Günther, 1859 "1858"; Bourret 1942
Callula pulchra, Günther 1864
Caloula pulchra, Stoliczka 1870
Calohyla pulchra, Peters and Doria 1878
Callula macrodactyla Boulenger, 1887; Parker 1934; Bourret 1942
Callula (*Kallula*) *pulchra*, Bourret 1927
Kaloula pulchra pulchra, Parker 1934
Kaloula pulchra hainana, Gressitt 1938

Kaloula pulchra macrocephala, Bourret 1942
Kaloula macrocephala Ohler 2003

Type locality and holotype specimen: China (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Cebu, Luzon, Mindoro, Palawan (Introduced; Diesmos et al. 2006; Sy et al. 2014).

Figures 20 and 38.

***Kaloula rigida* Taylor 1922**

Kaloula rigida Taylor 1922; Parker 1934; Slevin and Leviton 1956

Type locality and holotype specimen: Philippines, Luzon, Mountain Province, Kalinga, Balbalan (CAS 61475).

Philippine distribution: Luzon (Endemic).

Figures 20 and 38.

***Kaloula walteri* Diesmos, Brown, and Alcala 2002**

Kaloula walteri Diesmos, Brown, and Alcala 2002

Type locality and holotype specimen: Philipines, Luzon, Quezon Province, Barangay Lalo, Municipality of Tayabas, on the southeast slope of Mt. Banahao (14.066667°N, 121.483333°E; WGS84; 950 m elev.) (PNM 6725).

Philippine distribution: Luzon, Polillo (Endemic).

Figures 20 and 38.

***Microhyla petrigena* Inger and Frogner 1979**

Microhyla (*Microhyla*) *petrigena*, Dubois 1987

Type locality and holotype specimen: Malaysia, Borneo, Sarawak, Kapit District, Nanga Tekalit. (FMNH 207705).

Philippine distribution: Tawi-Tawi (Non-endemic).

Figures 20 and 38.

***Oreophryne anulata* (Stejneger 1908)**

Phrynixalus anulatus Stejneger 1908; Taylor 1920
Chaperina visaya Taylor 1920
Phrynixalus annulatus Taylor 1920
Oreophryne annulata, Parker 1934; Inger 1954

Type locality and holotype specimen: Philippines, Mindanao, Davao (USNM 35399).

Philippine distribution: Leyte, Mindanao, Samar (Endemic).

Figures 21 and 38.

***Oreophryne nana* Brown and Alcala 1967**

Oreophryne nana Brown and Alcala 1967

Type locality and holotype specimen: Philippines, Camiguin, Mt. Hibok-hibok, on the northwest side of Nacawa volcano (1,800–3,000 ft. elev.) (CAS-SU 22055).

Philippine distribution: Camiguin Sur (Endemic).

Figures 21 and 38.

Family Ranidae

***Amnirana nicobariensis* (Stoliczka 1870)**

Hyla bilineata Van-Ernest *in* Daudin 1800; Daudin *in* Sonnini de Manoncourt and Latreille 1801
Calamita bilineatus Merrem 1820
Auletris bilineatus, Wagler 1830
Hylorana nicobariensis Stoliczka 1870; Deckert 1938
Rana macularia var. *javanica* Horst 1883
Rana javanica, Boulenger 1884; Van Kampen 1907
Rana nicobariensis, Boulenger 1885
Rana erythraea var. *elongate*, Werner 1892
Rana lemniscata Boettger 1893
Rana (*Hylorana*) *nicobariensis*, Boulenger 1920
Rana sanchezi Taylor 1920
Rana suluensis Taylor 1920
Rana (*Hylorana*) *nicobariensis*, Boulenger 1920; Van Kampen 1923
Rana nicobariensis javanica, Mertens 1927
Rana nicobariensis nicobariensis, Inger 1954
Rana (*Sylvirana*) *nicobariensis*, Dubois 1992
Rana nicobariensis, Alcala and Brown 1998
Sylvirana nicobariensis, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana nicobariensis, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007
Amnirana nicobariensis, Oliver, Prendini, Kraus, and Raxworthy 2015

Type locality and holotype specimen: Indonesia, Java (Status and whereabouts of holotype u nknown; not traced).
Philippine distribution: Palawan, Sulu Archipelago (Non-endemic).
Figure 21.

***Hylarana erythraea* (Schlegel 1837)**

Hyla erythraea Schlegel 1837
Hylarana erythraea, Tschudi 1838; Bourret 1942; Fei, Ye, and Huang 1990; Chen, Murphy, Lathrop, Ngo, Orlov, Ho, and Somorjai 2005
Limnodytes erythraeus, Duméril and Bibron 1841
Hylorana erythraea, Günther 1864; Deckert 1938
Rana erythraea, Boulenger 1882
Rana (*Hylorana*) *erythraea*, Boulenger *in* Mason 1882
Rana (*Hylarana*) *erythraea*, Müller 1887
Rana (*Limnodytes*) *erythraea*, Bourret 1927

Type locality and holotype specimen: Sumatra (RMNH 1744, 1746, 1749; MNHNP 4570–4572, syntypes).
Philippine distribution: Borocay, Calagna-an, Guimaras, Leyte, Luzon, Masbate, Mindoro, Negros, Panay, Romblon Island Group, Samar (Introduced; Diesmos et al. 2006).
Figures 21 and 38.

***Lithobates catesbeianus* (Shaw 1802)**

Rana catesbeiana Shaw, 1802; Boulenger 1920; Dubois 1987 "1986"
Rana pipiens Daudin 1802
Rana taurina Cuvier 1817
Rana mugiens Merrem, 1820
Rana scapularis Harlan, 1826
Rana conspersa Le Conte 1855
Rana catesbyana Cope 1889; Werner 1909
Rana (*Rana*) *catesbeiana*, Boulenger, 1920
Rana nantaiwuensis Hsü 1930
Rana mugicus Angel 1947
Rana (*Aquarana*) *catesbeiana*, Dubois, 1992; Hillis 2007
Rana (*Novirana*, *Aquarana*) *catesbeiana*, Hillis and Wilcox 2005
Lithobates catesbeianus, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, Green, and Wheeler, 2006
Lithobates (*Aquarana*) *catesbeianus*, Dubois 2006

Type locality and holotype specimen: North America (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Leyte, Luzon, Mindanao, Mindoro, Panay (Introduced; Diesmos et al. 2006).

Figures 22 and 39.

***Pulchrana grandocula* (Taylor 1920)**

Rana grandocula Taylor 1920; Inger and Tan 1996
Rana philippinensis Taylor 1920
Rana yakani Taylor 1922
Rana signata gradocula, Inger 1954; Alcala and Brown 1998
Rana signata, Frost 1985
Rana (*Pulchrana*) *grandocula*, Dubois 1992
Pulchrana grandocula, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana grandocula, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007; Brown and Siler 2013
Pulchrana grandocula, Oliver, Prendini, Kraus, and Raxworthy 2015

Type locality and holotype specimen: Philippines, Mindanao, Agusan Province, near Bunawan (CM 3501).

Philippine distribution: Basilan, Biliran, Bohol, Camiguin Sur, Dinagat, Leyte, Mindanao, Samar (Endemic).

Figures 22 and 39.

***Pulchrana guttmani* (Brown 2015)**

Rana grandocula Brown and Guttman 2002 (partim)
Hylarana sp. 2, Brown and Siler 2013
Hylarana guttmani Brown 2015

Type locality and holotype specimen: Philippines, southern Mindanao Island, South Cotobato Province (~2 km north of border with Sarangani Province), Municipality of Kiamba,

Barangay Badtasan, Sitio Banate, Mt. Busa (6.0923°N, 124.6709°E; WGS84; 1,200 m elev.) (PNM 9790, formerly KU 326399).

Philippine distribution: Mindanao (Endemic).

Figure 43.

***Pulchrana mangyanum* (Brown and Guttman 2002)**

Rana mangyanum Brown and Guttman 2002

Pulchrana mangyanum, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006

Hylarana mangyanum, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007; Brown and Siler 2013

Pulchrana mangyanum, Oliver, Prendini, Kraus, and Raxworthy 2015

Type locality and holotype specimen: Philippines, Mindoro, Oriental Mindoro Province, Municipality of Puerto Galera (within 1 km of the border of the Municipality of San Teodoro), Barangay Villaflor (15 km from Puerto Gallera City on Puerto Gallera-Calapan Road), Tamaraw Falls (unnamed river) (150 m elev.) (PNM 6270).

Philippine distribution: Mindoro, Semirara (Endemic).

Figures 22 and 39.

***Pulchrana melanomenta* (Taylor 1920)**

Rana melanomenta Taylor 1920; Brown and Gittman 2002

Rana (*Pulchrana*) *melanomenta*, Dubois 1992

Pulchrana melanomenta, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006

Hylarana melanomenta, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007; Brown and Siler 2013

Pulchrana melanomenta, Oliver, Prendini, Kraus, and Raxworthy 2015

Type locality and holotype specimen: Philippines, Sulu Archipelago, Papahag Island (Bur. Sci. Manila No. 1661, destroyed).

Philippine distribution: Papahag (Endemic).

Figure 22.

***Pulchrana moellendorffi* (Boettger 1893)**

Rana moellendorffi Boettger 1893; Brown and Gittman 2002

Rana (*Hylarana*) *moellendorffi*, Boulenger 1920

Rana signata moellendorffi, Inger 1954; Alcala and Brown 1998

Rana (*Hylarana*) *moellendorffi*, Dubois 1987 "1986"

Rana (*Pulchrana*) *moellendorffi*, Dubois 1992

Pulchrana moellendorffi, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006

Hylarana moellendorffi, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007; Brown and Siler 2013

Pulchrana moellendorffi, Oliver, Prendini, Kraus, and Raxworthy 2015

Type locality and holotype specimen: Philippines, Calamanianes Island Group, Culion Island (SMF 5432).

Philippine distribution: Balabac, Busuanga, Caluit, Coron, Culion, Palawan (Endemic).
Figures 23 and 39.

***Pulchrana similis* (Günther 1873)**

Polypedates similis Günther 1873
Rana similis, Boulenger 1882; Brown and Guttman 2002
Rana (*Hylarana*) *signata* Boulenger 1920
Rana signata similis, Inger 1954; Alcala and Brown 1998
Rana (*Pulchrana*) *similis*, Dubois 1992
Pulchrana similis, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana similis, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007; Brown and Siler 2013
Pulchrana similis, Oliver, Prendini, Kraus, and Raxworthy 2015

Type locality and holotype specimen: Philippines, Luzon, Laguna del Bay (Status and whereabouts of holotype unknown; not traced).
Philippine distribution: Cagraray, Catanduanes, Luzon, Polillo, Rapu-Rapu (Endemic).
Figures 23 and 39.

***Sanguirana albotuberculata* (Inger 1954)**

Rana everetti albotuberculata Inger 1954
Rana (*Chalcorana*) *albotuberculata*, Dubois 1992
Rana albotuberculata, Brown, McGuire, and Diesmos 2000
Hydrophylax albotuberculata, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana albotuberculata, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007
Chalcorana albotuberculata, Fei, Ye, and Jiang 2010
Sanguirana albotuberculata, Fuiten, Welton, Diesmos, Barley, Oberheide, Duya, Rico, and Brown 2011

Type locality and holotype specimen: Philippines, Leyte, Cabalian (MCZ 23190).
Philippine distribution: Leyte, Mindanao, Samar (Endemic).
Figures 23 and 39.

***Sanguirana aurantipunctata* Fuiten, Welton, Diesmos, Barley, Oberheide, Duya, Rico, and Brown 2011**

Type locality and holotype specimen: Philippines, Luzon, Nueva Vizcaya Province, Municipality of Quezon, Barangay Maddiangat, Sitio Parola, Mt. Palali (16.438°N, 121.225°E; WGS84; 1,500 m elev.) (PNM 9727).
Philippine distribution: Luzon (Endemic).
Figures 23 and 39.

***Sanguirana everetti* (Boulenger 1882)**

Rana everetti Boulenger 1882; Brown, McGuire, and Diesmos 2000
Rana mearnsi Stejneger 1905
Rana dubita Taylor 1920
Rana (*Hylarana*) *everetti*, Boulenger 1920
Rana (*Hylarana*) *mearnsi* Boulenger 1920
Rana merrilli Taylor 1922

Rana (*Hylarana*) *everetti*, Van Kampen 1923; Dubois 1987 "1986"
Rana everetti everetti, Inger 1954
Rana (*Chalcorana*) *everetti*, Dubois 1992
Hydrophylax everetti, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana everetti, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007
Chalcorana everetti, Fei, Ye, and Jiang 2010
Sanguirana everetti, Fuiten, Welton, Diesmos, Barley, Oberheide, Duya, Rico, and Brown 2011

Type locality and holotype specimen: Philippines, Mindanao, Zamboanga (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Mindanao (Endemic).

Figures 24 and 39.

***Sanguirana igorota* (Taylor 1922)**

Rana igorota Taylor 1922; Brown, McGuire, and Diesmos 2000
Rana everetti luzonensis Inger 1954
Rana (*Chalcorana*) *luzonensis*, Dubois 1992
Hydrophylax igorata, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana igorota, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007
Chalcorana igorota, Fei, Ye, and Jiang 2010
Sanguirana igorata, Fuiten, Welton, Diesmos, Barley, Oberheide, Duya, Rico, and Brown 2011

Type locality and holotype specimen: Philippines, Luzon, Kalinga Subprovince, Balbalan (CAS 61484).

Philippine distribution: Luzon (Endemic).

Figures 24 and 40.

***Sanguirana luzonensis* (Boulenger 1896)**

Rana luzonensis Boulenger 1896; Dubois 1987 "1986"; Brown, McGuire, and Diesmos 2000
Rana (*Hylarana*) *luzonensis*, Boulenger 1920
Rana guerreroi Taylor 1920
Rana merilli Taylor 1922
Rana igorata Taylor 1922
Rana tafti Taylor 1922
Rana everetti luzonensis, Inger 1954; Alcala and Brown 1998
Rana (*Chalcorana*) *luzonensis*, Dubois 1992
Hydrophylax luzonensis, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana luzonensis, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007
Chalcorana luzonensis, Fei, Ye, and Jiang 2010
Sanguirana luzonensis, Fuiten, Welton, Diesmos, Barley, Oberheide, Duya, Rico, and Brown 2011

Type locality and holotype specimen: Philippines, N. Luzon Highlands of Lepauto (= Lepanto) (Status and whereabouts of holotype unknown; not traced).
Philippine distribution: Luzon, Catanduanes, Marinduque, Polillo (Endemic).
Figures 24 and 40.

***Sanguirana sanguinea* (Boettger 1893)**

Rana sanguinea, Boettger 1893; Inger 1954
Rana varians Boulenger 1894
Rana (*Hylarana*) *sanguinea*, Boulenger 1920
Rana (*Hylarana*) *varians*, Boulenger 1920
Hylorana varians, Deckert 1938
Rana (*Hylarana*) *sanguinea*, Dubois 1987 "1986"
Rana (*Hylarana*) *varians*, Dubois 1987 "1986"
Hylarana (*Hylarana*) *varians*, Fei, Ye, and Huang 1990
Rana (*Sanguirana*) *sanguinea*, Dubois 1992
Rana (*Sanguirana*) *varians*, Dubois 1992
Hylarana sanguinea, Song, Jang, Zou, and Shi 2002
Sanguirana sanguinea, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Sanguirana varians Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006

Type locality and holotype specimen: Philippines, Calamianes Island Group, Culion Island (SMF 1062a, now SMF 6221).
Philippine distribution: Busuanga, Culion, Palawan (Endemic).
Figures 24 and 40.

***Sanguirana tipanan* (Brown, McGuire, and Diesmos 2000)**

Rana tipanan Brown, McGuire, and Diesmos 2000
Hydrophylax tipanan, Frost, Grant, Faivovich, Bain, Haas, Haddad, de Sá, Channing, Wilkinson, Donnellan, Raxworthy, Campbell, Blotto, Moler, Drewes, Nussbaum, Lynch, and Green 2006
Hylarana tipanan, Che, Pang, Zhao, Wu, Zhao, and Zhang 2007
Chalcorana tipanan, Fei, Ye, and Jiang 2010
Sanguirana tipanan, Fuiten, Welton, Diesmos, Barley, Oberheide, Duya, Rico, and Brown 2011

Type locality and holotype specimen: Philippines, Luzon, Aurora Province, Municipality of San Luis, Aurora National Park, 1.2 km S, 1.3 km E of Barangay Villa Aurora, east side of Mt. Ma-aling-aling in the Kabatangan river drainage (15.651667°N, 121.351944°E; 470 m elev.) (PNM 5727).
Philippine distribution: Luzon (Endemic).
Figures 25 and 40.

***Staurois natator* (Günther 1858)**

Ixalus natator Günther 1858
Ixalus guttatus Günther 1858

Staurois natator, Cope 1865; Inger 1954
Rana natatrix Boulenger 1882
Ixalus granulatus Boettger 1888
Staurois nubilus, Boulenger 1918
Rhacophorus granulosus Ahl 1927
Rana guttatus Smith 1931

Type locality and holotype specimen: Philippines (BMNH 1933.9.19.10.9–11, syntypes).
Philippine distribution: Basilan, Biliran, Bohol, Dinagat, Leyte, Mindanao, Samar (Endemic).
Figures 25 and 40.

***Staurois nubilus* (Mocquard 1890)**

Ixalus nubilus Mocquard 1890
Ixalus natator var. *nubilus*, Mocquard 1892; Guibé 1950
Staurois nubilus, Boulenger 1918; Decker 1938; Inger and Tan 1996

Type locality and holotype specimen: Philippines, Palawan (MNHNP 1889.344–46, syntypes).
Philippine distribution: Busuanga, Culion, Palawan (Endemic).
Figures 25 and 40.

Family Rhacophoridae

***Kurixalus appendiculatus* (Günther 1858)**

Polypedates appendiculatus Günther 1858
Rhacophorus appendiculatus, Boulenger 1882; Ahl 1931; Brown and Alcala 1994; Harvey, Pemberton, and Smith 2002
Rhacophorus phyllopygus Werner 1900
Rhacophorus chaseni Smith 1924
Rhacophorus appendiculatus chaseni, Smith 1930
Rhacophorus appendiculatus appendiculatus, Smith 1930; Inger 1954
Rhacophorus (*Rhacophorus*) *chaseni*, Ahl 1931
Rhacophorus (*Rhacophorus*) *appendiculatus appendiculatus*, Wolf 1936
Leptomantis appendiculatus, Iskandar and Colijn 2000
Kurixalus appendiculatus, Yu, Zhang, and Yang 2013

Type locality and holotype specimen: Philippines (Status and whereabouts of holotype unknown; not traced).
Philippine distribution: Basilan, Bohol, Camiguin Sur, Leyte, Luzon, Mindanao, Samar (Non-endemic).
Figures 25 and 40.

***Nyctixalus pictus* (Peters 1871)**

Ixalus pictus Peters 1871
Rhacophorus anodon Van Kampen 1907
Philautus pictus, Barbour 1912
Philautus anodon, Van Kampen 1923
Rhacophorus (*Philautus*) *anodon*, Ahl 1931
Rhacophorus (*Philautus*) *pictus*, Ahl 1931
Hazelia picta, Taylor 1962
Philautus pictus pictus, Inger 1966
Hazelia anodon, Liem 1970
Nyctixalus anodon, Dubois 1981

Edwardtayloria picta, Dring 1982
Edwardtayloria picta, Alcala 1986
Nyctixalus pictus, Brown and Alcala 1994; Matsui 1996

Type locality and holotype specimen: Malaysia (Borneo), Sarawak (MSNG 10062).
Philippine distribution: Palawan (Endemic).
Figure 26.

***Nyctixalus spinosus* (Taylor 1920)**

Hazelia spinosa Taylor 1920
Rhacophorus (*Philautus*) *spinosus*, Ahl 1931
Rhacophorus leprosus spinosus, Wolf 1936
Philautus spinosus, Inger 1954
Hazelia spinosa, Liem 1970
Edwardtayloria spinosa, Marx 1975
Nyctixalus spinosus, Dubois 1981; Brown and Alcala 1994
Edwardtayloria spinosa, Alcala 1986

Type locality and holotype specimen: Philippines, Mindanao, Agusan Province, Bunawan (CM 3420).
Philippine distribution: Basilan, Bohol, Leyte, Mindanao, Samar (Endemic).
Figures 26, 40, and 41.

***Philautus acutirostris* (Peters 1867)**

Ixalus acutirostris Peters 1867
Philautus acutirostris, Stejneger 1905; Inger 1954
Philautus woodi Stejneger 1905
Philautus basilanensis Taylor 1922
Rhacophorus (*Philautus*) *woodi* Ahl 1931
Rhacophorus (*Philautus*) *basilanensis* Ahl 1931
Rhacophorus (*Philautus*) *acutirostris*, Ahl 1931
Philautus (*Philautus*) *acutirostris*, Dubois 1987 "1986"

Type locality and holotype specimen: Philippines, eastern Mindanao (NMW 22885, ZMB 5690, syntypes).
Philippine distribution: Basilan, Bohol, Mindanao (Endemic).
Figures 26 and 41.

***Philautus everetti* (Boulenger 1894)**

Rhacophorus everetti Boulenger 1894
Polypedates everetti, Taylor 1920
Rhacophorus (*Rhacophorus*) *buergeri everetti*, Wolf 1936
Rhacophorus everetti everetti, Inger 1954
Philautus everetti, Hertwig, Das, Schweizer, Brown, and Haas 2012

Type locality and holotype specimen: Philippines, Palawan (BMNH 94.6.3.126–127, syntypes).
Philippine distribution: Palawan (Endemic).
Figures 26 and 41.

***Philautus leitensis* (Boulenger 1897)**

Ixalus leitensis Boulenger 1897
Philautus leitensis, Stejneger 1905; Inger 1954; Bossuyt and Dubois 2001

Rhacophorus (*Philautus*) *leitensis*, Ahl 1931
Type locality and holotype specimen: Philippines, Leyte (BMNH 96.12.11.92).
Philippine distribution: Bohol, Leyte, Mindanao, Samar (Endemic).
Figures 27 and 41.

***Philautus longicrus* (Boulenger 1894)**
Ixalus longicrus Boulenger 1894
Philautus longicrus, Stejneger 1905; Inger 1954
Rhacophorus (*Philautus*) *longicrus*, Ahl 1931
Philautus (*Philautus*) *longicrus*, Bossuyt and Dubois 2001
Type locality and holotype specimen: Philippines, Palawan (BMMH 94.6.30.129–131, now BMMH 1947.2.6.28–30, syntypes).
Philippine distribution: Palawan (Non-endemic).
Figures 27 and 41.

***Philautus poecilus* Brown and Alcala 1994**
Philautus poecilus Brown and Alcala 1994
Philautus (*Philautus*) *poecilus*, Bossuyt and Dubois 2001
Type locality and holotype specimen: Philippines, Mindanao, Agusan del Norte Province, south side of Mt. Hilong-hilong (CAS 133526).
Philippine distribution: Mindanao (Endemic).
Figures 27 and 41.

***Philautus schmackeri* (Boettger 1892)**
Ixalus schmackeri Boettger 1892
Ixalus mindorensis Boulenger 1897
Philautus schmackeri, Stejneger 1905; Taylor 1920; Inger 1954; Dubois 1987 "1986"
Philautus mindorensis Taylor 1920; Stejneger 1905
Rhacophorus (*Philautus*) *schmackeri*, Ahl 1931
Rhacophorus (*Philautus*) *mindorensis* Ahl 1931
Type locality and holotype specimen: Philippines, Mindoro, Mt. Halcone (SMF 1099a, now SMF 7035).
Philippine distribution: Mindoro (Endemic).
Figure 27.

***Philautus surdus* (Peters 1863)**
Polypedates surdus Peters 1863
Rhacophorus surdus, Boulenger 1882
Philautus williamsi Taylor 1922
Rhacophorus (*Philautus*) *williamsi*, Ahl 1931
Rhacophorus (*Rhacophorus*) *surdus*, Ahl 1931
Rhacophorus (*Rhacophorus*) *buergeri surdus*, Wolf 1936
Rhacophorus lissobrachius Inger 1954
Rhacophorus surdus, Inger 1954
Philautus surdus, Liem 1970; Brown and Alcala 1994
Philautus lissobrachius, Liem 1970
Philautus (*Philautus*) *lissobrachius*, Dubois 1987 "1986"

Philautus (*Philautus*) *surdus*, Dubois 1987 "1986"
Type locality and holotype specimen: Philippines, Luzon (ZMB 4920).
Philippine distribution: Bohol, Luzon, Mindanao (Endemic).
Figures 28 and 41.

***Philautus surrufus* Brown and Alcala 1994**

Rhacophorus surdus Rabor and Alcala 1959 (partim)
Philautus surrufus, Brown and Alcala 1994
Philautus (*Philautus*) *surrufus*, Bossuyt and Dubois 2001
Type locality and holotype specimen: Philippines, Mindanao, Misamis Occidental Province, about 10 km SE of Masawan, on the west side of Dapitan Peak (1,800–1,900 m elev.) (CAS-SU 21013).
Philippine distribution: Mindanao (Endemic).
Figure 28.

***Philautus worcesteri* (Stejneger 1905)**

Cornufer worcesteri Stejneger 1905
Rhacophorus emembranatus Inger 1954
Philautus emembranatus Liem 1970
Philautus (*Philautus*) *emembranatus*, Dubois 1987 "1986"
Philautus worcesteri, Brown, Alcala, and Brown 1998
Type locality and holotype specimen: Philippines, Mindanao, Mount Apo (6,000 ft. elev.) (USNM 34784).
Philippine distribution: Mindanao (Endemic).
Figures 28 and 41.

***Polypedates leucomystax* (Gravenhorst 1829)**

Hyla leucomystax Gravenhorst 1829
Hyla sexvirgata Gravenhorst 1829
Hyla quadrilineata Wiegmann 1834
Polypedates leucomystax, von Tschudi 1838
Hyla leucopogon von Tschudi 1838
Hyla quadrivirgata von Tschudi 1838
Polypedates rugosus Duméril and Bibron 1841
Polypedates quadrilineatus, Günther 1859 "1858"
Limnodytes celebensis Fitzinger 1861 "1860"
Polypedates hecticus Peters 1863; Taylor 1920
Rhacophorus hecticus, Boulenger 1882
Rhacophorus maculatus var. *quadrilineata*, Boulenger 1882
Hylorana longipes Fischer 1885
Polypedates maculatus quadrilineatus, Fischer 1885
Rhacophorus maculatus Boetger 1886
Rhacophorus leucomystax, Boulenger 1889; Van Kampen 1923; Ahl 1931
Rhacophorus leucomystax leucomystax, Mocquard 1890
Rhacophorus leucomystax quadrilineatus, Mocquard 1890; Inger 1954
Rhacophorus leucomystax var. *sexvirgata*, Boettger 1894
Rhacophorus leucomystax quadrilineata, Werner 1903

Rhacophorus maculatus leucomystax, Annandale 1912
Rhacophorus maculatus himalayensis Annandale 1912
Hyla wirzi Roux 1927
Polypedates leucomystax, Taylor 1920
Rhacophorus (*Polypedates*) *leucomystax*, Bourret 1927
Rhacophorus (*Polypedates*) *quadrilineatus*, Bourret 1927
Rhacophorus kampeni Ahl 1927
Rhacophorus (*Rhacophorus*) *hecticus* Ahl 1931
Rhacophorus (*Rhacophorus*) *himalayanus*, Ahl 1931
Rhacophorus (*Rhacophorus*) *kampeni*, Ahl 1931
Rhacophorus (*Rhacophorus*) *leucomystax leucomystax*, Wolf 1936
Rhacophorus (*Rhacophorus*) *wirzi* Forcart 1946
Polypedates leucomystax, Alcala 1986
Polypedates leucomystax, Dutta 1997

Type locality and holotype specimen: Indonesia, Java (Status and whereabouts of holotype unknown; not traced).

Philippine distribution: Batan, Bohol, Cagayan, Cagraray, Calagna-an, Caluya, Camiguin Norte, Camiguin Sur, Catanduanes, Cebu, Dinagat, Fuga, Gigantes Norte, Gigantes Sur, Guimaras, Inampulugan, Jolo, Leyte, Lubang, Luzon, Mactan, Marinduque, Masbate, Mindanao, Mindoro, Negros, Pacijan, Palaui, Palawan, Pan de Azucar, Panay, Polillo, Romblon Island Group, Samar, Semirara, Sibay, Sicogan, Verde (Non-endemic).

Figures 28 and 42.

***Polypedates macrotis* (Boulenger 1891)**

Rhacophorus macrotis Boulenger 1891
Polypedates macrotis, Günther 1895; Liem 1970; Alcala 1986
Philautus montanus Taylor 1920
Polypedates linki Taylor 1922
Rhacophorus (*Philautus*) *alticola* Ahl 1931
Rhacophorus (*Rhacophorus*) *macrotis*, Ahl 1931
Rhacophorus (*Rhacophorus*) *lincki* Ahl 1931
Rhacophorus leucomystax linki, Wolf 1936; Inger 1954
Rhacophorus (*Polypedates*) *macrotis*, Bossuyt and Dubois 2001

Type locality and holotype specimen: Borneo, Sarawak, Baram district (BMNH 91.1.27.8, now BMNH 1947.2.8.18).

Philippine distribution: Busuanga, Calauit, Dumaran, Palawan, Sulu Archipelago (Non-endemic).

Figures 29 and 42.

***Rhacophorus bimaculatus* (Peters 1867)**

Leptomantis bimaculata Peters 1867
Ixalus bimaculatus, Boulenger 1882
Philautus bimaculatus, Stejneger 1905; Inger 1954
Philautus zamboangensis Taylor 1922
Rhacophorus (*Philautus*) *bimaculatus*, Ahl 1931
Rhacophorus bimaculatus, Liem 1970
Rhacophorus (*Leptomantis*) *bimaculatus*, Dubois 1987 "1986"
Leptomantis bimaculatus, Iskandar and Colijn 2000
Rhacophorus bimaculatus, Brown and Alcala 1994; Harvey, Pemberton, and Smith 2002

Type locality and holotype specimen: Philippines, Mindanao, Upper Valley of the Agusan (ZMB 5681, NHMW 16091, syntypes).
Philippine distribution: Bohol, Catanduanes, Dinagat, Leyte, Luzon, Mindanao, Polillo, Samar (Endemic).
Figures 29 and 42.

***Rhacophorus pardalis* Günther 1858**

Rhacophorus pardalis Günther 1858
Rhacophorus rizali Boettger 1897, 1899
Rhacophorus pulchellus Werner 1900
Polypedates pardalis, Taylor 1920
Rhacophorus (*Rhacophorus*) *pardalis*, Ahl 1931
Rhacophorus (*Rhacophorus*) *pulchellus*, Ahl 1931
Rhacophorus pardalis pardalis, Wolf 1936; Inger 1954
Rhacophorus pardalis pulchellus, Wolf 1936
Rhacophorus pardalis rhyssocephalus, Wolf 1936
Rhacophorus rhyssocephalus, Inger and Voris 2001

Type locality and holotype specimen: Philippines (Status and whereabouts of holotype unknown; not traced).
Philippine distribution: Basilan, Bohol, Camiguin Sur, Catanduanes, Dinagat, Leyte, Luzon, Mindanao, Mindoro, Negros, Romblon Island Group, Samar, Siquijor (Non-endemic).
Figures 29 and 42.

Class Amphibia, Order Gymnophiona

Family Ichthyophiidae

***Ichthyophis glandulosus* (Taylor 1923)**

Ichthyophis glandulosus Taylor 1923
Ichthyophis monochrous Inger 1954; Alcala 1986

Type locality and holotype specimen: Philippines, Basilan, Abungabung (= Abung Abung) (CAS 60073).
Philippine distribution: Basilan, Mindanao (Endemic).
Figures 29 and 42.

***Ichthyophis mindanaoensis* (Taylor 1960)**

Ichthyophis monochrous Inger 1954; Alcala 1986
Ichthyophis mindanaoensis Taylor 1960

Type locality and holotype specimen: Philippines, Mindanao, Davao Province, Mt. Apo, Todaya (2,800 ft. elev.) (FMNH 50958).
Philippine distribution: Mindanao (Endemic).
Figure 30.

***Ichthyophis weberi* Taylor 1920**

Ichthyophis weberi Taylor 1920
Caudacaecilia weberi, Taylor 1923, 1968
Ichthyophis monochrous Inger 1954; Alcala 1986
Ichthyophis weberi, Nishikawa, Matsui, Yong, Ahmad, Yambun, Belabut, Sudin, Hamidy, Orlov, Ota, Yoshikawa, Tominaga, and Shimada 2012

Type locality and holotype specimen: Philippines, Palawan, Malatgan River (CAS-SU 21758, neotype).
Philippine distribution: Palawan (Endemic).
Figure 30.

Conclusions

Our understanding of biodiversity of amphibians in the Philippines has increased substantially over the last century as a result of continued faunal surveys over a greater proportion of the archipelago and, more recently, with the increased availability of genetic data guiding identification and discovery of unique evolutionary lineages (Brown et al. 2013). Vouchered global collections now exceed 43,000 specimen records, housed among more than 30 museums in seven countries. The amphibian fauna in the Philippines includes members of nine anuran families (Bombinatoridae, Bufonidae, Ceratobatrachidae, Dicroglossidae, Eleutherodactylidae, Megophryidae, Microhylidae, Ranidae, Rhacophoridae) and one gymnophionan family (Ichthyophiidae). Four of these families are represented by endemic species only in the archipelago (Bombinatoridae, Ceratobatrachidae, Ichthyophiidae, Megophryidae).

What once was considered a depauperate amphibian fauna composed of a number of widespread species distributed across larger regions of Southeast Asia (Inger 1954; Brown and Alcala 1970a, b), we take note of the fact that the diversity of endemic amphibian species in the Philippines has risen precipitously (Figure 1) in recent years. Currently, there are 112 species recorded in the archipelago, 94 of which are endemic (83.9% amphibian endemicity). In contrast, truly widespread (non-endemic) species account for only 16.1% (18 species; Figure 1). Furthermore, nearly one-third of the country's non-endemic species are the result of introductions (*Eleutherodactylus planirostris*, *Hoplobatrachus rugulosus*, *Hylarana erythraea*, *Kaloula pulchra*, *Lithobates catesbeianus*, and *Rhinella marina*; Figure 1). Although the rate of discovery of non-endemic species of amphibians has slowed considerably over the last hundred years, the number of endemic species continues to grow with little indication of slowing. Within the last 20 years alone, 27 new amphibian species have been described (nearly one-quarter of the country's recognized diversity), all endemic to the Philippines (Figure 1). These data suggest that considerable cryptic diversity and underestimated regional diversity exist throughout the archipelago. Continued efforts to describe and study the archipelago's amphibian fauna are necessary for successful conservation of threatened taxa and clarification of the broader evolutionary mechanisms that drive such diversity.

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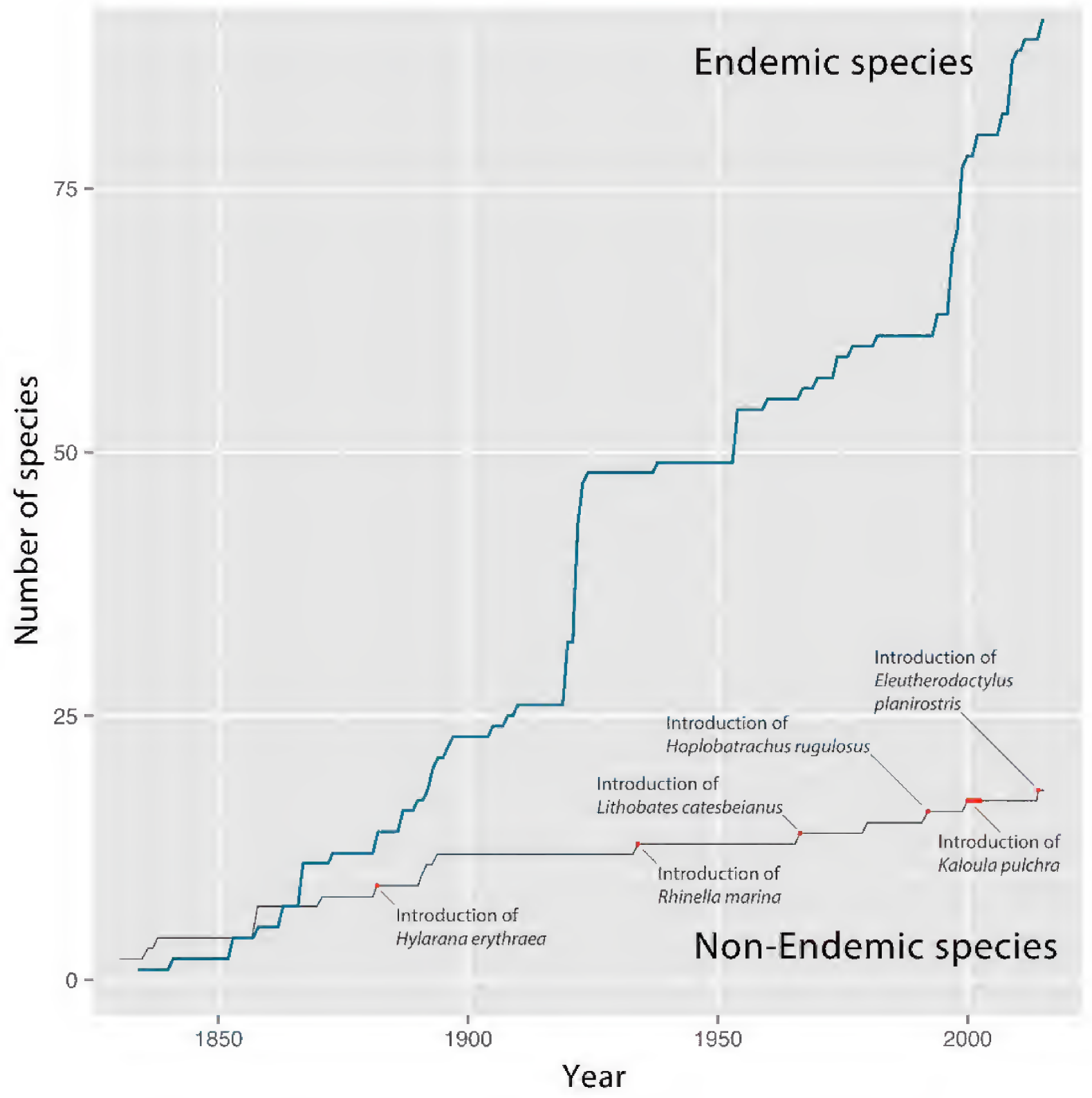

FIGURE 1.—Species accumlation curve for new amphibian species described in the Philippines, from 1758–2015.

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Author Contributions

CDS, RMB, ACD, and JLW conceived the ideas; ACD, NAH, ACA, RIC, LEA, GGD, RVS, MBS, MLD, EYS, LJW, RMB, and CDS participated in fieldwork; JLW, MBS, MLP, MJL, CSD, EAL, and CDS compiled and analyzed the dataset; NAH created the maps; DRD created the photo plates; JLW, NAH, DRD, RMB, and CDS revised analyzed the data; ACD and JLW led the writing; JLW, NAH, and CDS wrote the introduction and discussion; and JLW, CDS, NAH, DRD, and RMB edited drafts of the manuscript.

Distribution Maps and Photographs

Figures 2–44

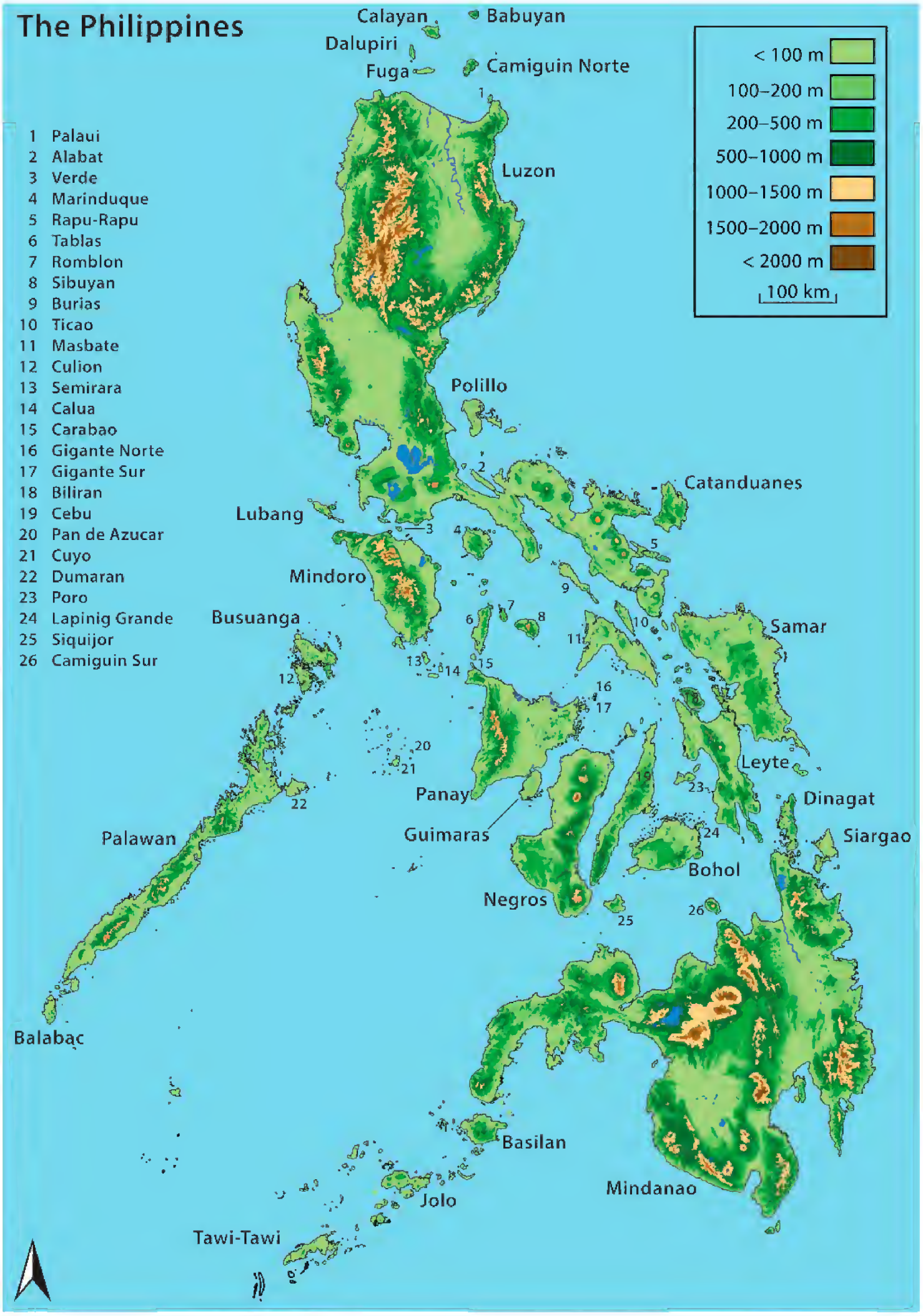

FIGURE 2. Topographic map of the Philippine archipelago, with island names provided for larger islands. Numeric labels for smaller islands correspond to inset key.

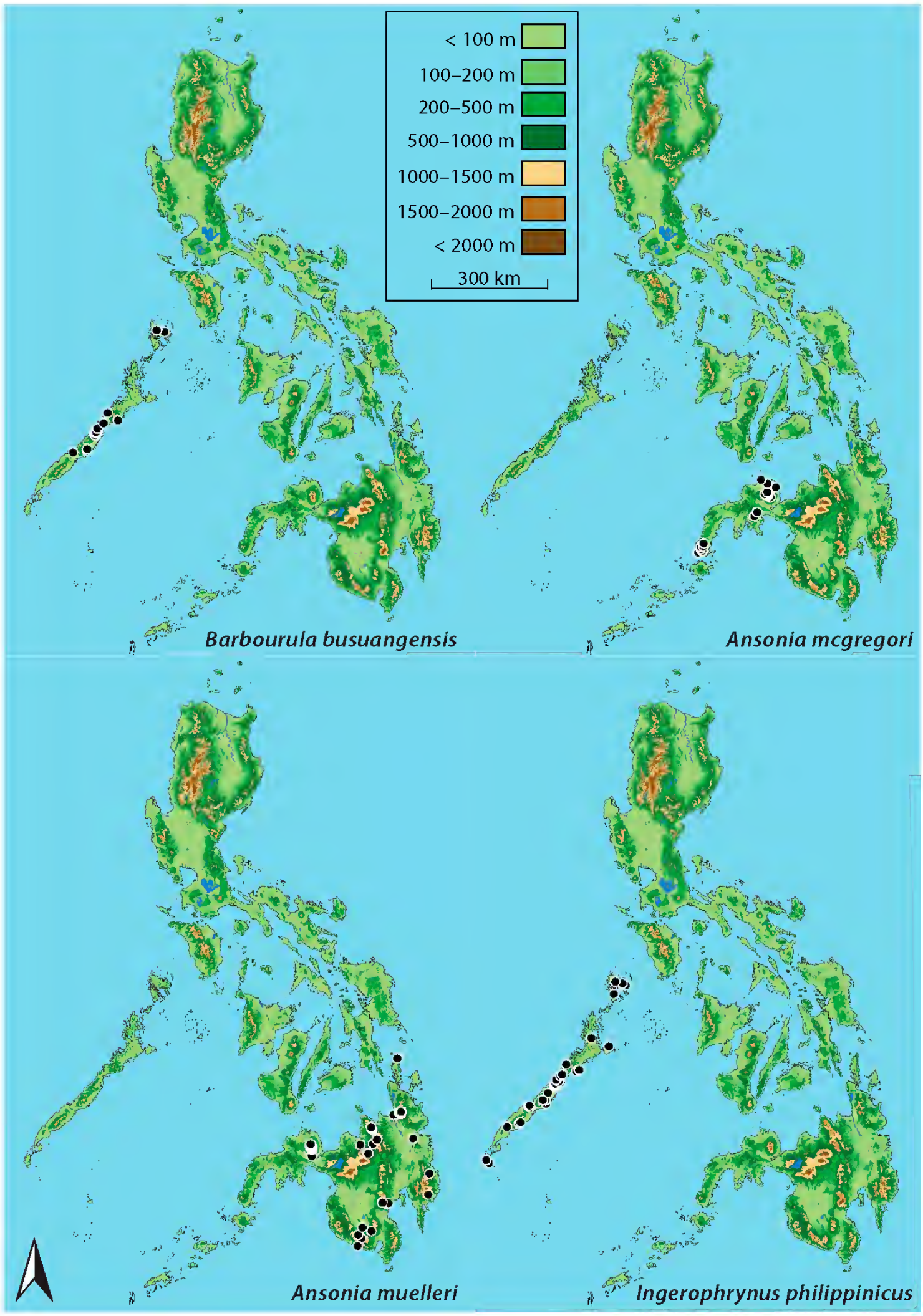

FIGURE 3. Geographic range maps for members of the families Bombinatoridae (*Barbourula busuangensis*), and Bufonidae (*Ansonia mcgregori*, *A. muelleri*, and *Ingerophrynus philippinicus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

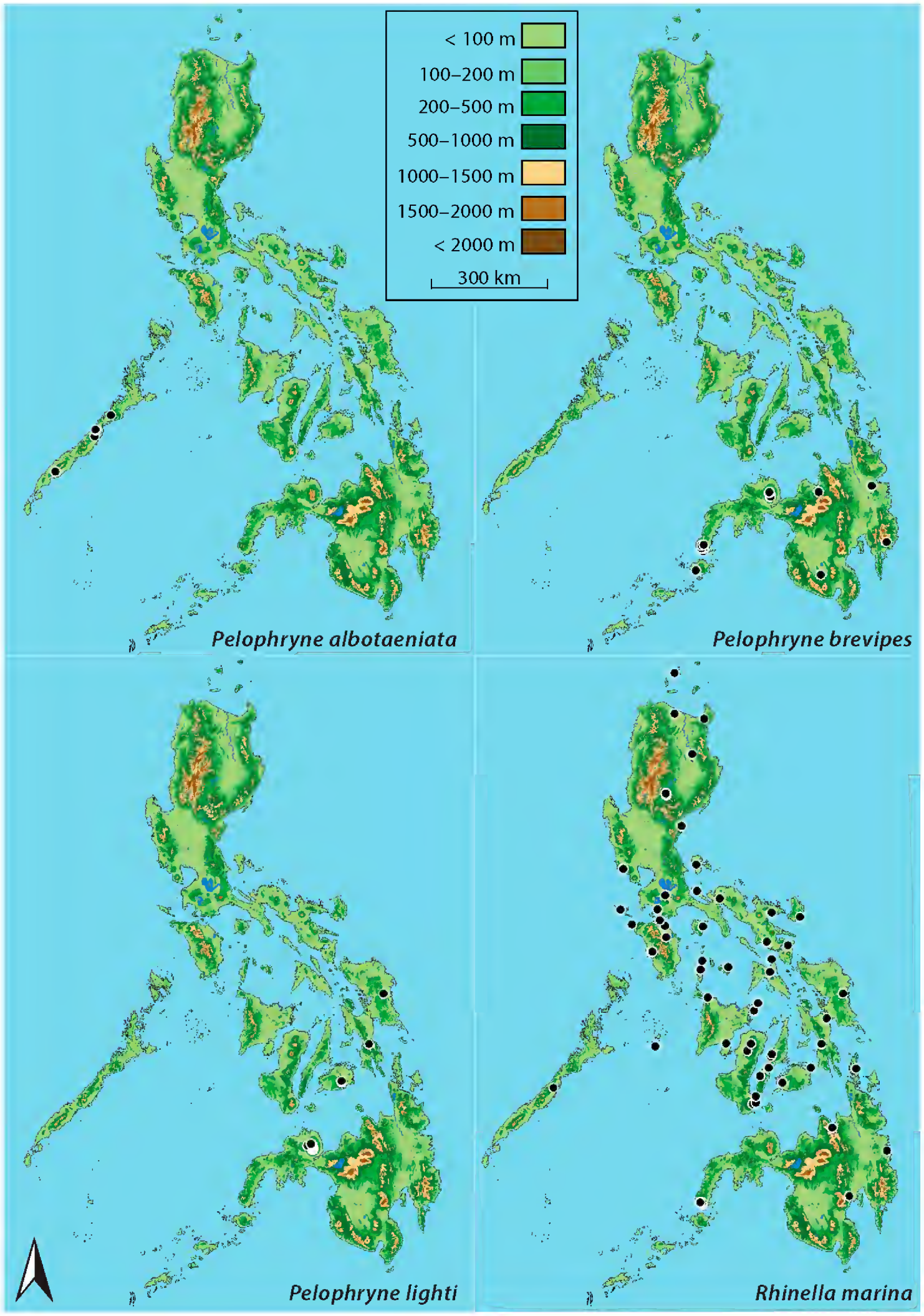

FIGURE 4. Geographic range maps for members of the family Bufonidae (*Pelophryne albotaeniata*, *P. brevipes*, *P. lighti*, and *Rhinella marina*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

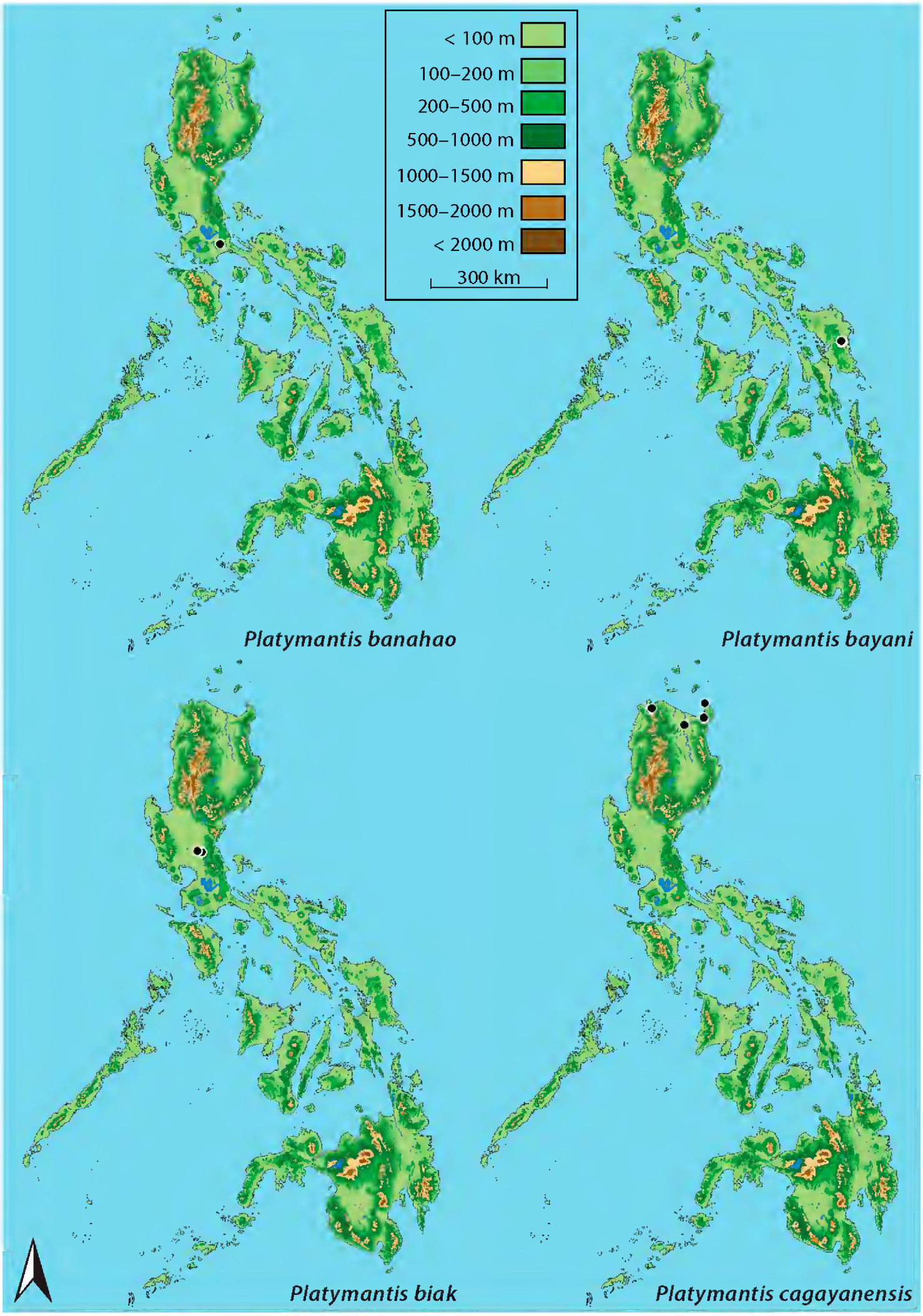

FIGURE 5. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis banahao*, *P. bayani*, *P. biak*, and *P. cagayanensis*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

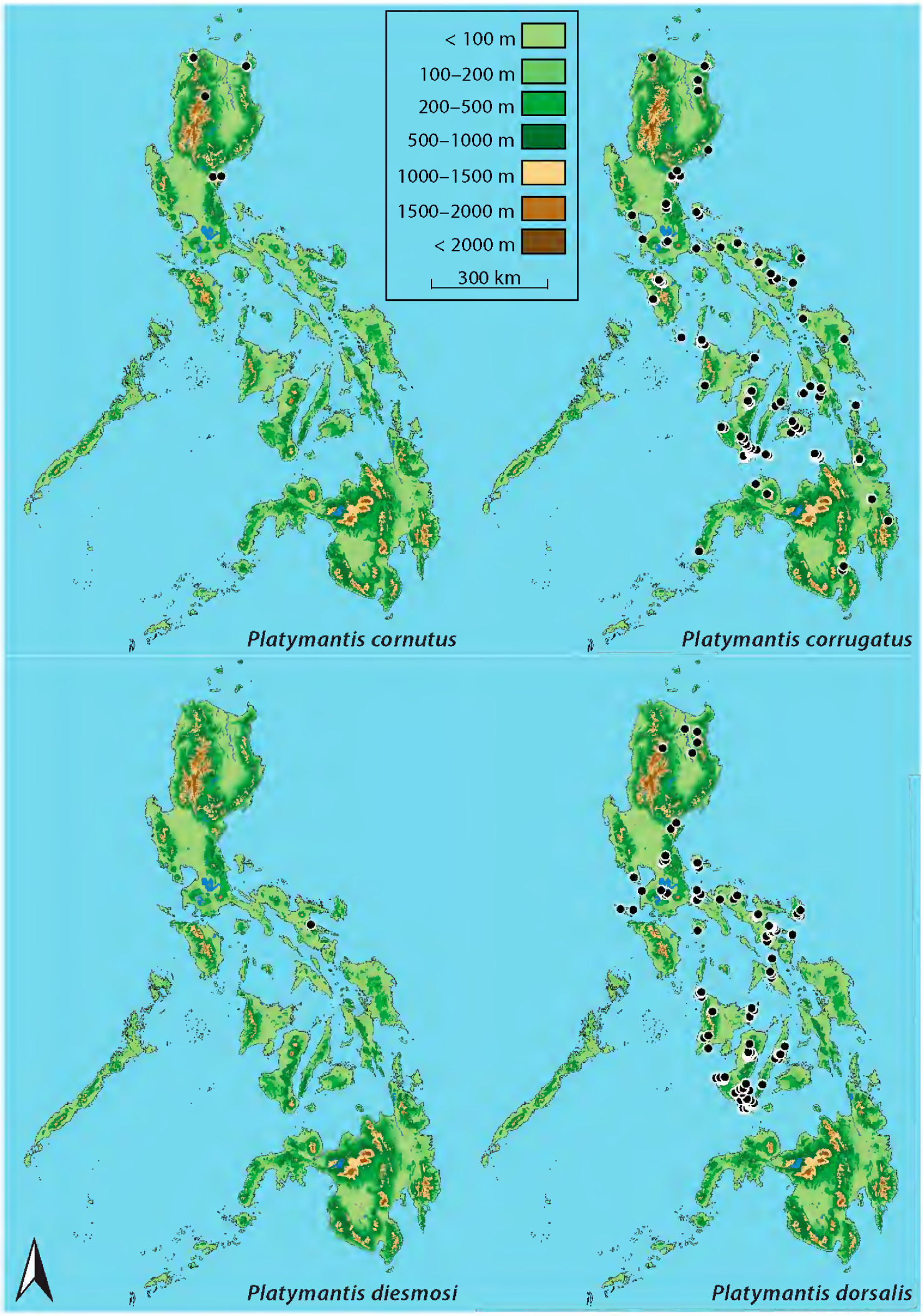

FIGURE 6. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis cornutus*, *P. corrugatus*, *P. diesmosi*, and *P. dorsalis*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

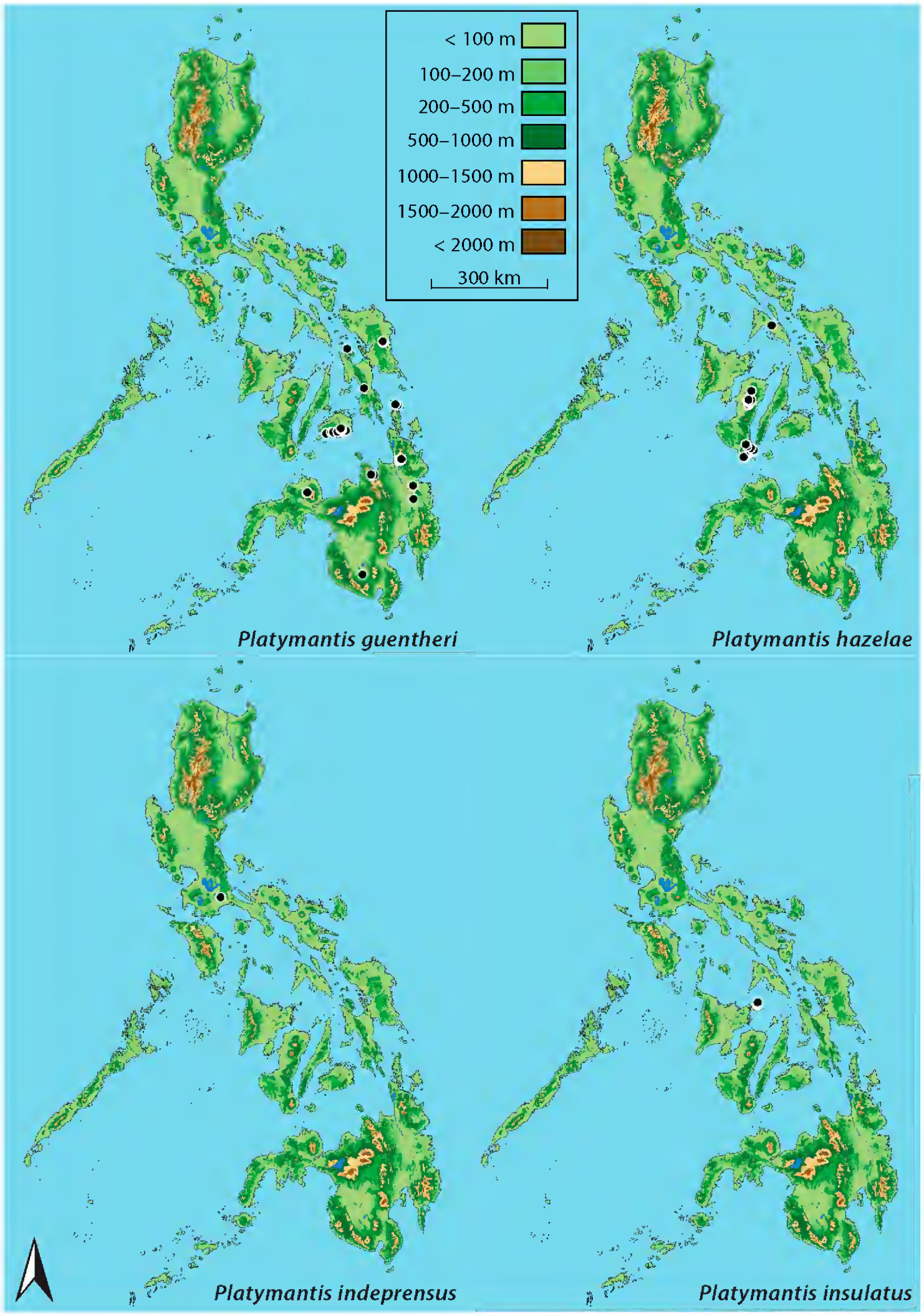

FIGURE 7. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis guentheri*, *P. hazelae*, *P. indeprensus*, and *P. insulatus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

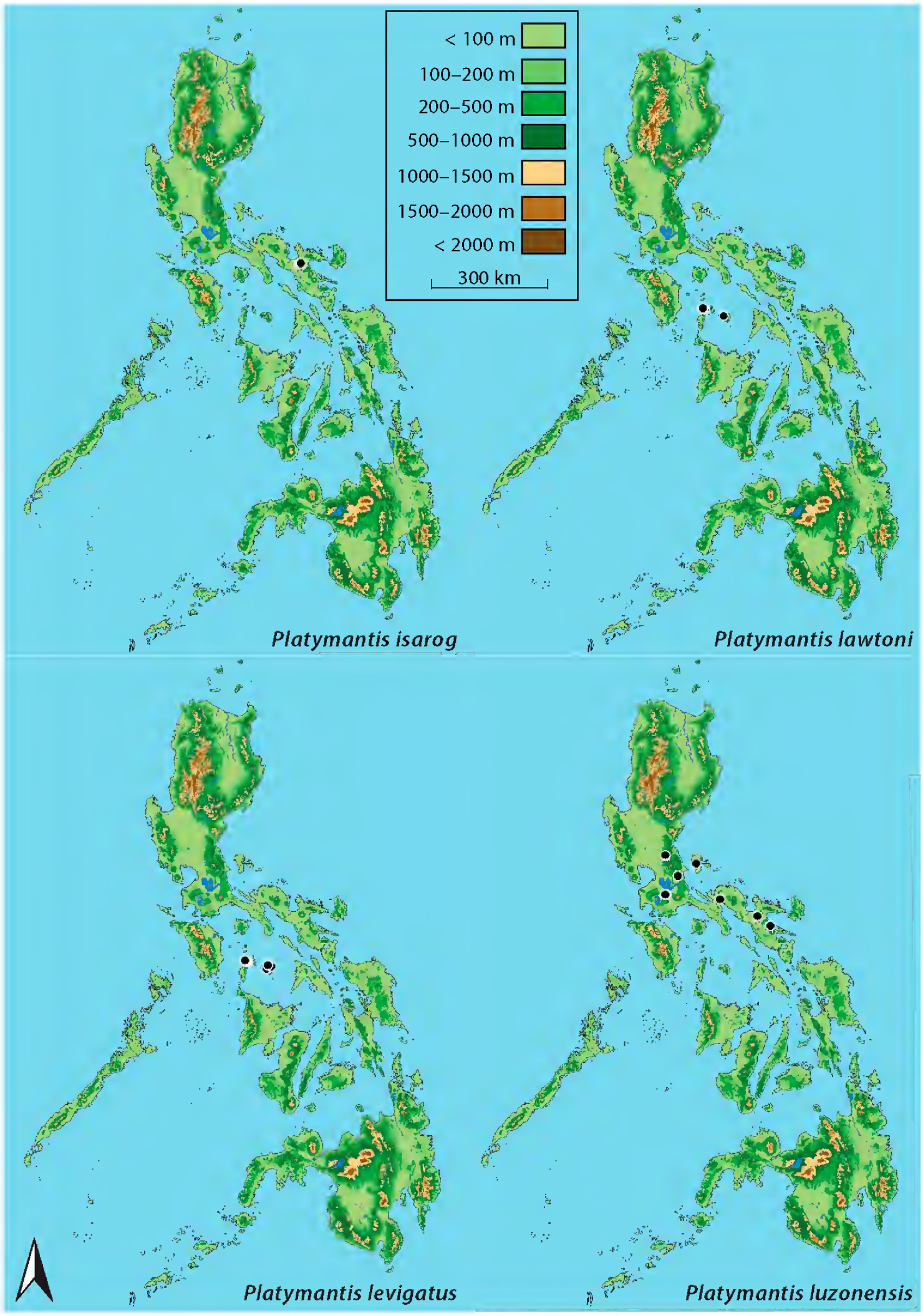

FIGURE 8. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis isarog*, *P. lawtoni*, *P. levigatus*, and *P. luzonensis*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

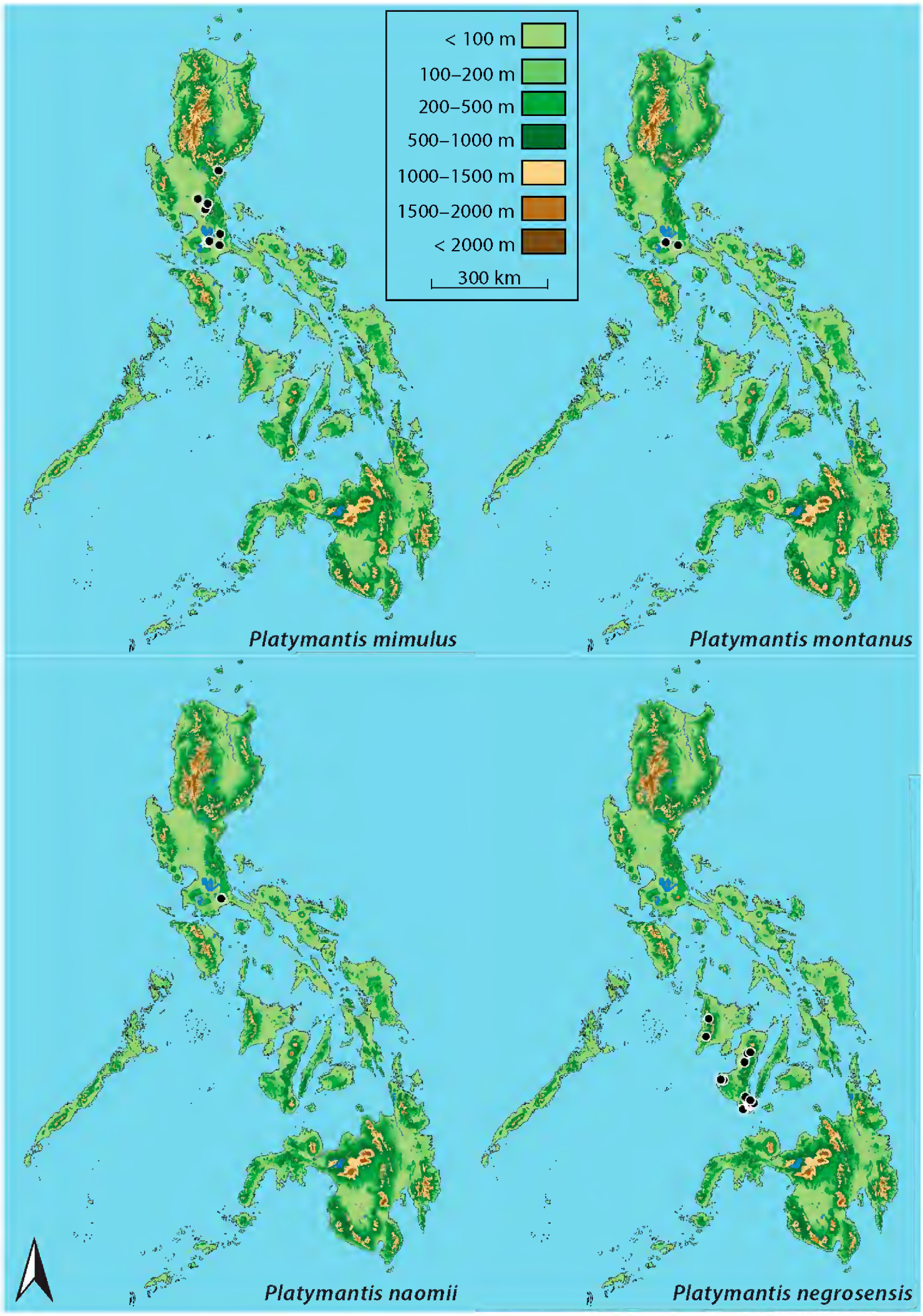

FIGURE 9. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis mimulus*, *P. montanus*, *P. naomii*, and *P. negrosensis*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

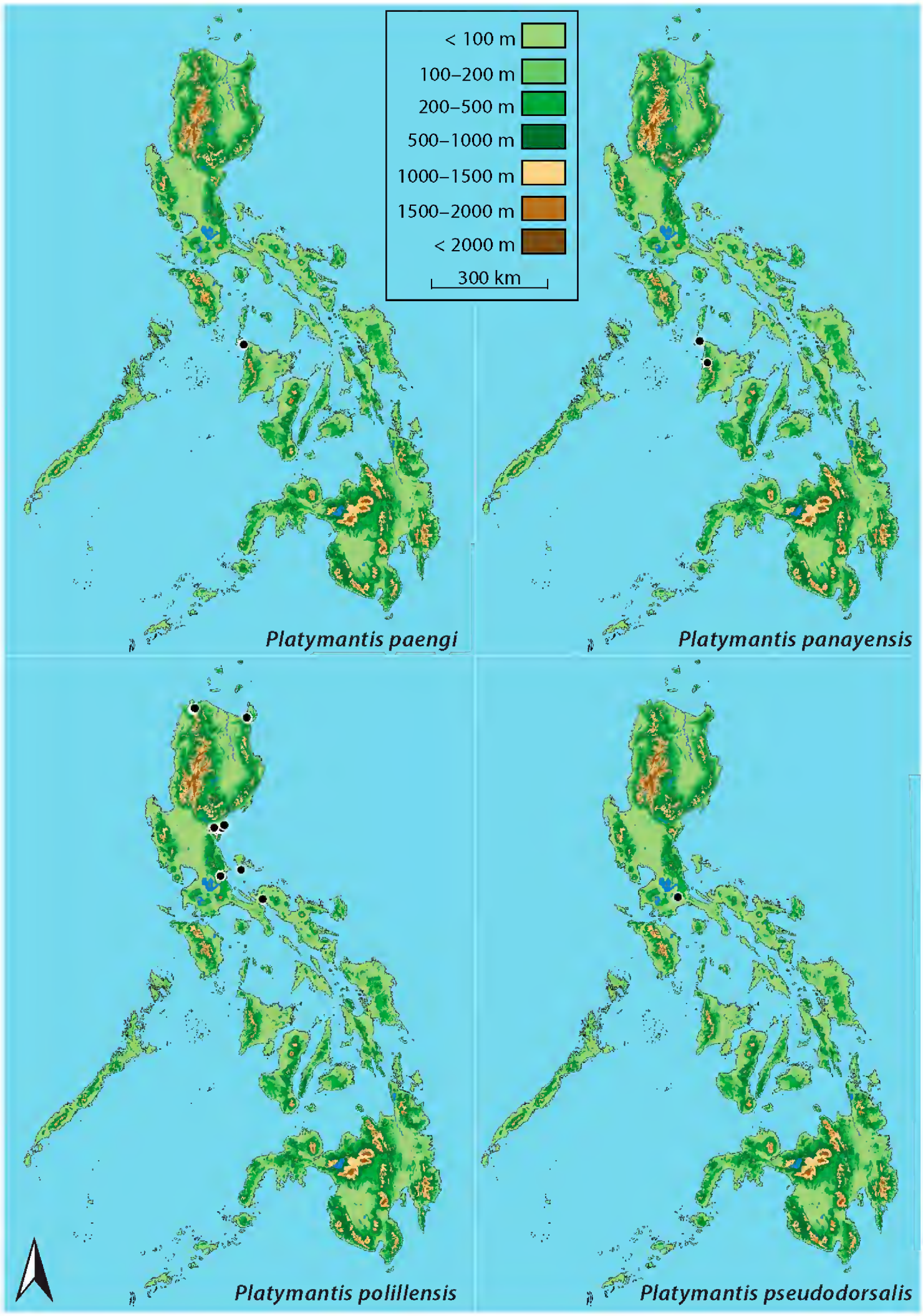

FIGURE 10. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis paengi*, *P. panayensis*, *P. polillensis*, and *P. pseudodorsalis*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

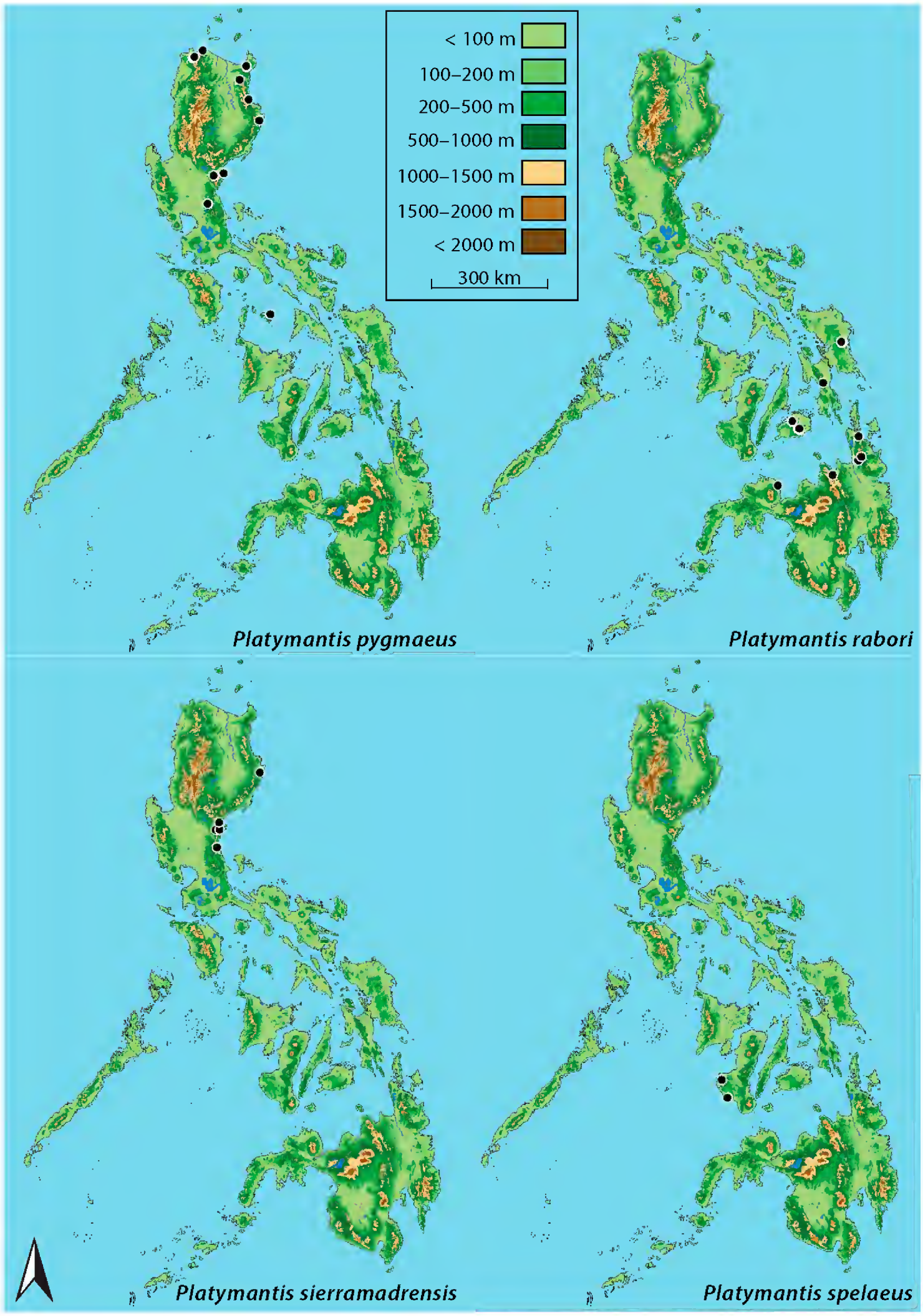

FIGURE 11. Geographic range maps for members of the family Ceratobatrachidae (*Platymantis pygmaeus*, *P. rabori*, *P. sierramadrensis*, and *P. spelaeus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

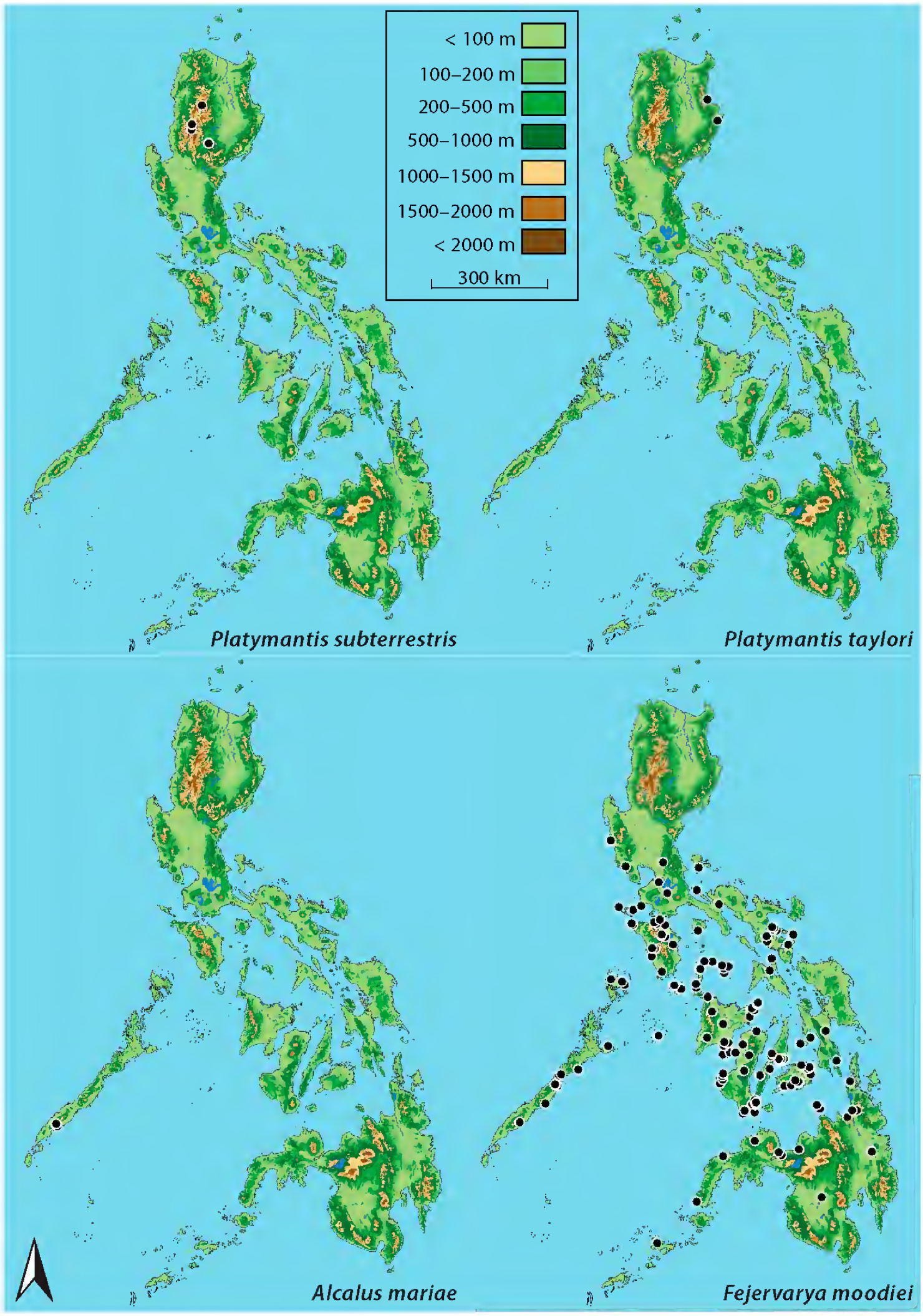

FIGURE 12. Geographic range maps for members of the families Ceratobatrachidae (*Platymantis subterrestris*, *P. taylori*, and *Alcalus mariae*) and Dicroglossidae (*Fejervarya moodiei*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

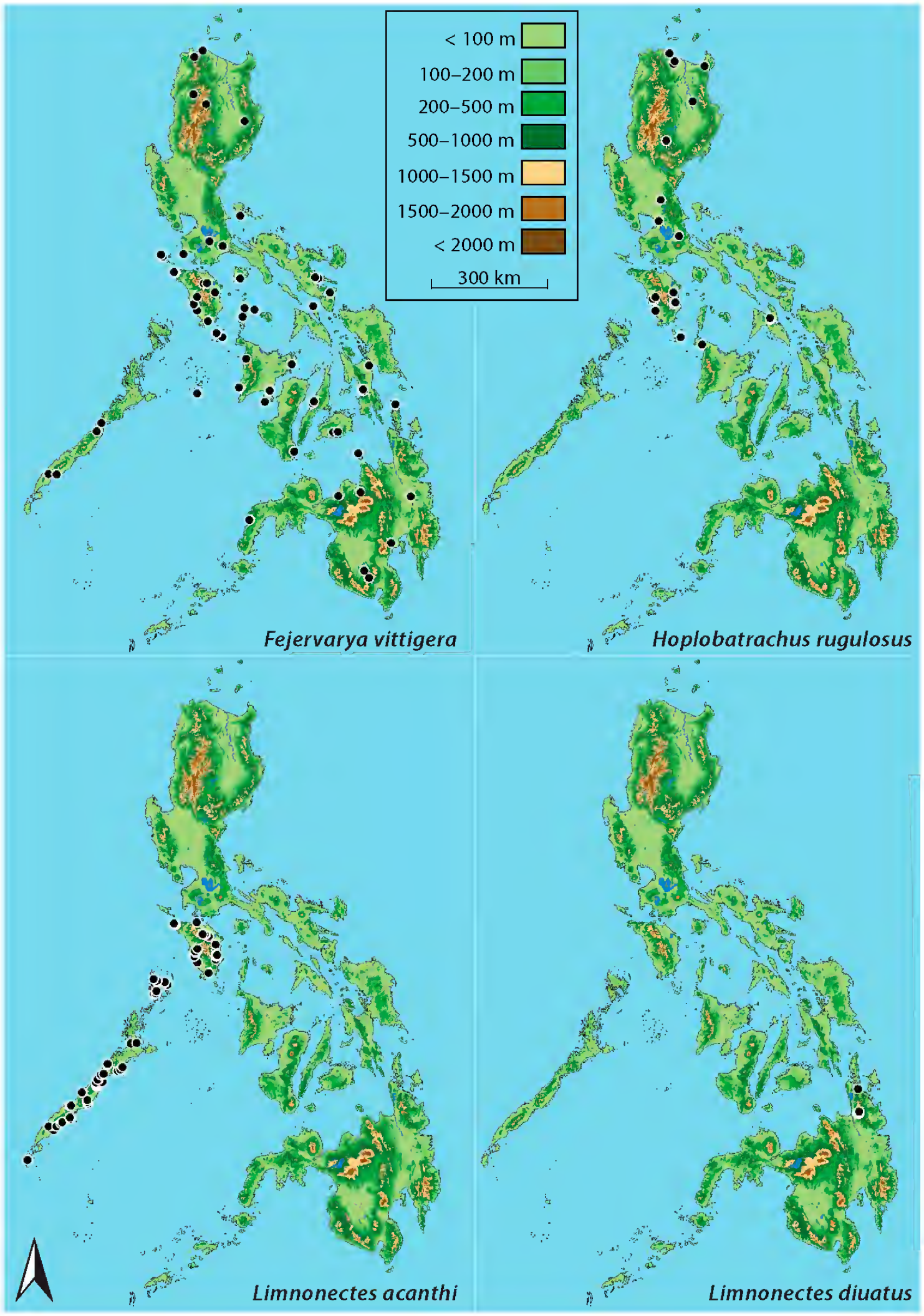

FIGURE 13. Geographic range maps for members of the family Dicroglossidae (*Fejervarya vittigera*, *Hoplobatrachus rugulosus*, *Limnonectes acanthi*, and *L. diuatus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

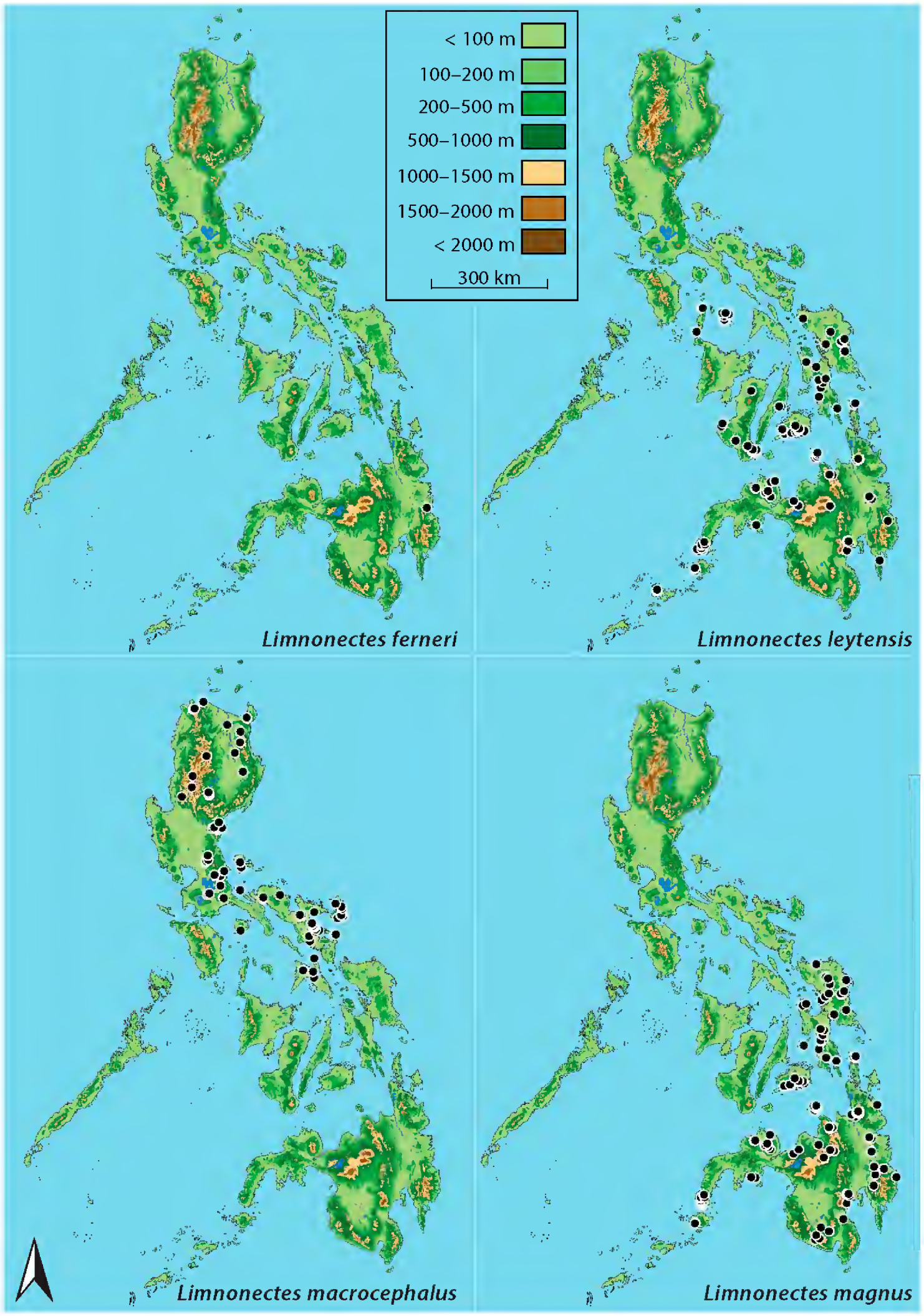

FIGURE 14. Geographic range maps for members of the family Dicroglossidae (*Limnonectes ferneri*, *L. leytensis*, *L. macrocephalus*, and *L. magnus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

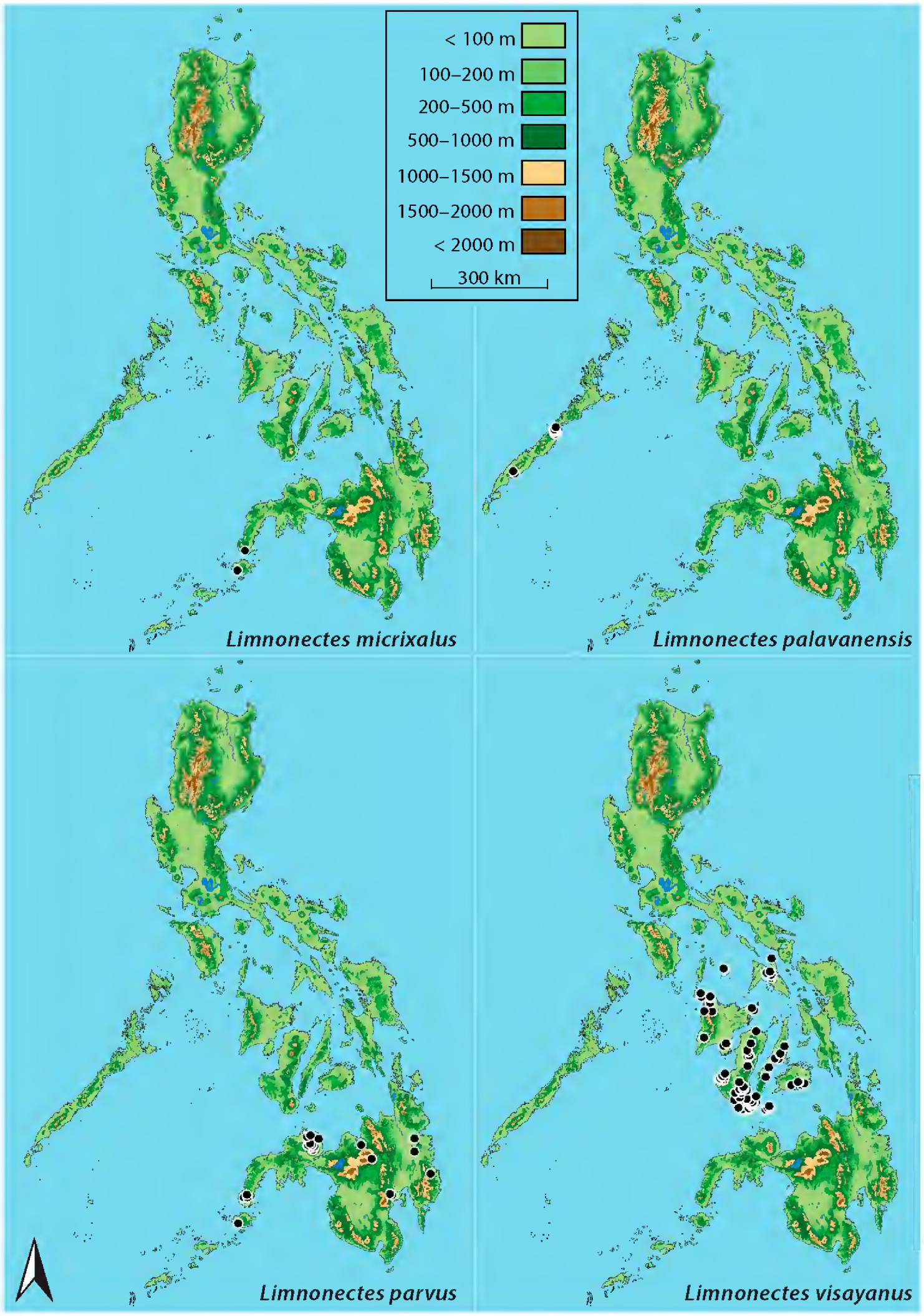

FIGURE 15. Geographic range maps for members of the family Dicroglossidae (*Limnonectes micrixalus*, *L. palavanensis*, *L. parvus*, and *L. visayanus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

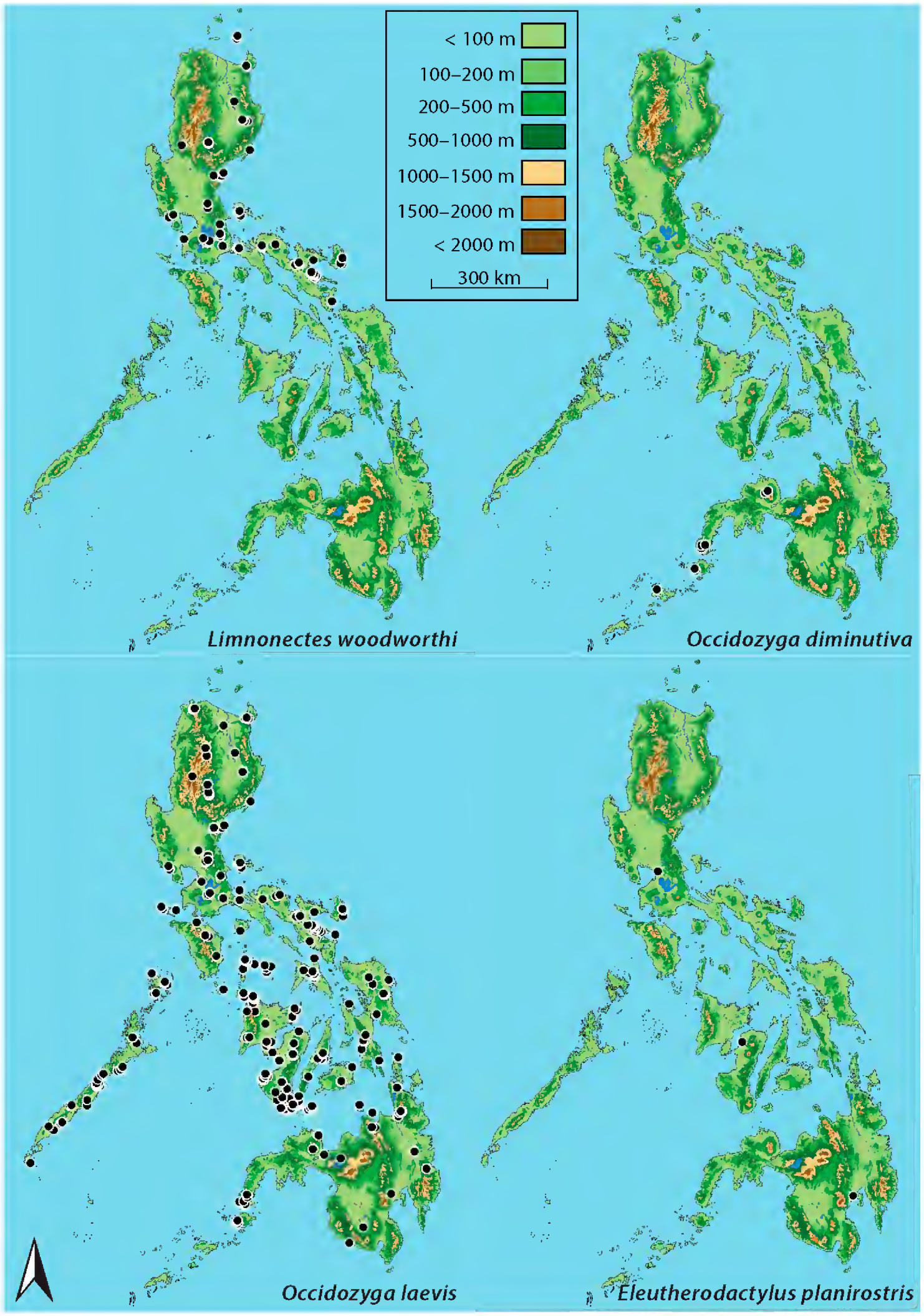

FIGURE 16. Geographic range maps for members of the families Dicroglossidae (*Limnonectes woodworthi*, *Occidozyga diminutiva*, and *O. laevis*), and Eleutherodactylidae (*Eleutherodactylus planirostris*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

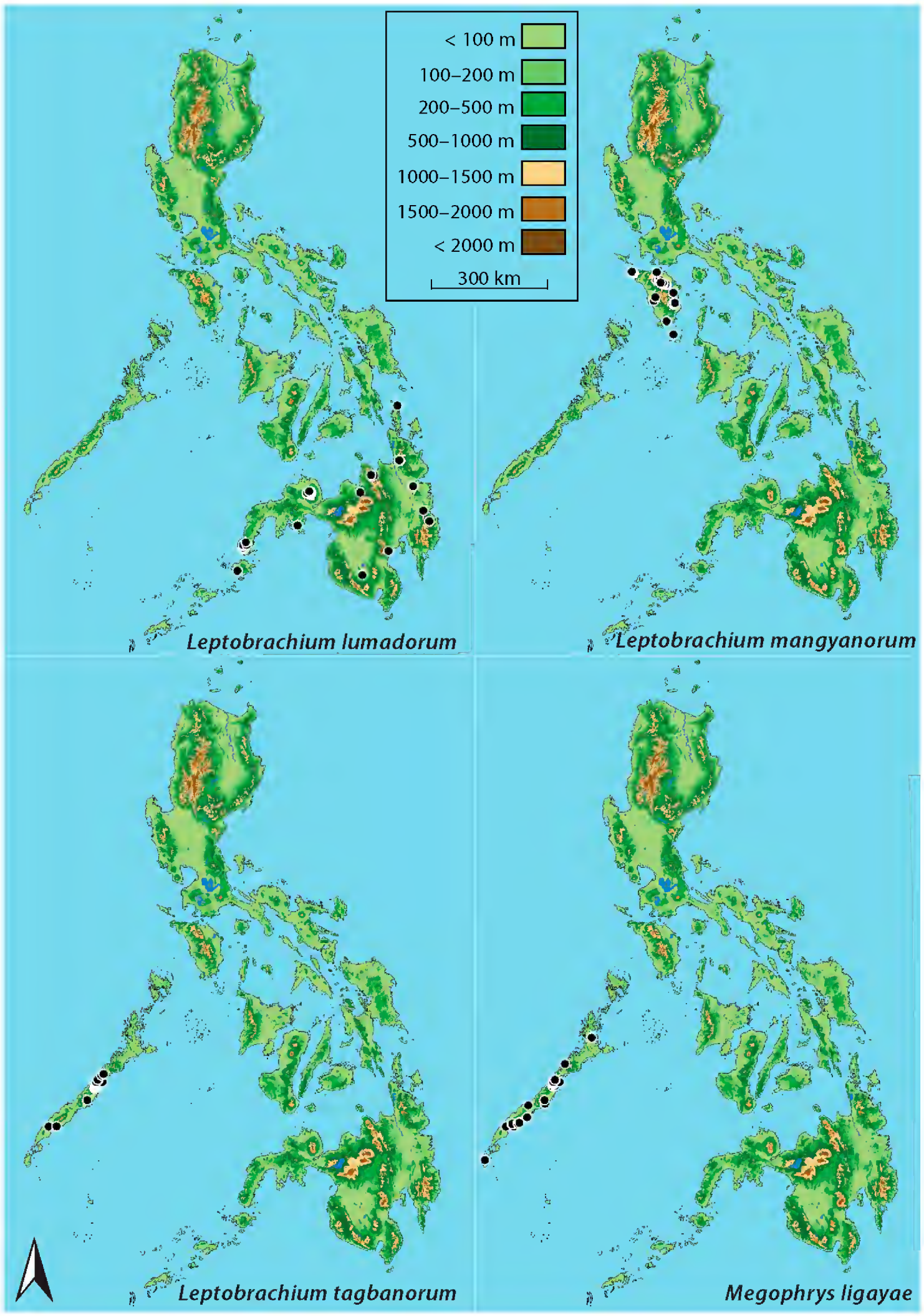

FIGURE 17. Geographic range maps for members of the family Megophryidae (*Leptobrachium lumadorum*, *L. mangyanorum*, *L. tagbanorum*, and *Megophrys ligayae*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

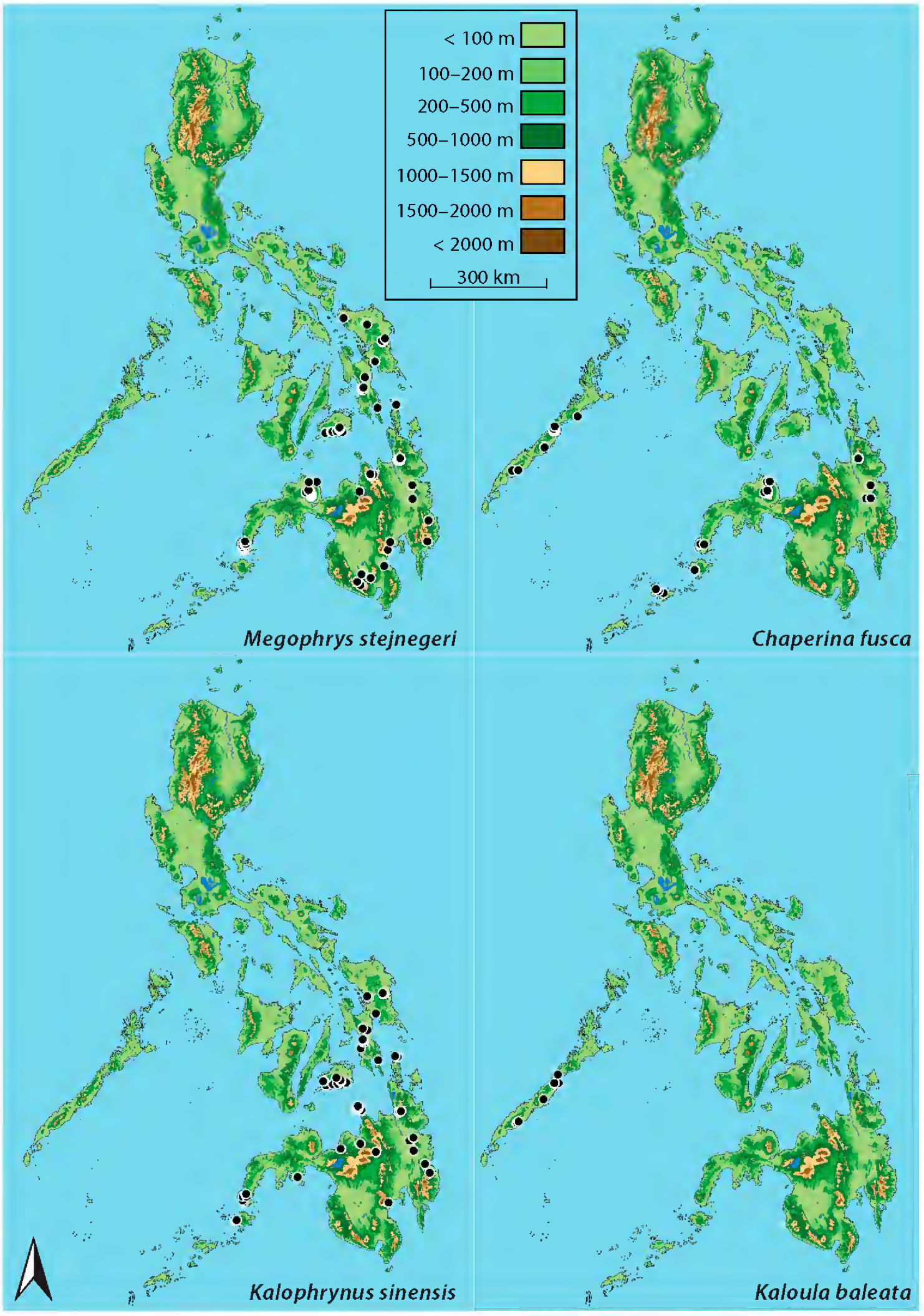

FIGURE 18. Geographic range maps for members of the families Megophryidae (*Megophrys stejnegeri*), and Microhylidae (*Chaperina fusca*, *Kalophrynus sinensis*, and *Kaloula baleata*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

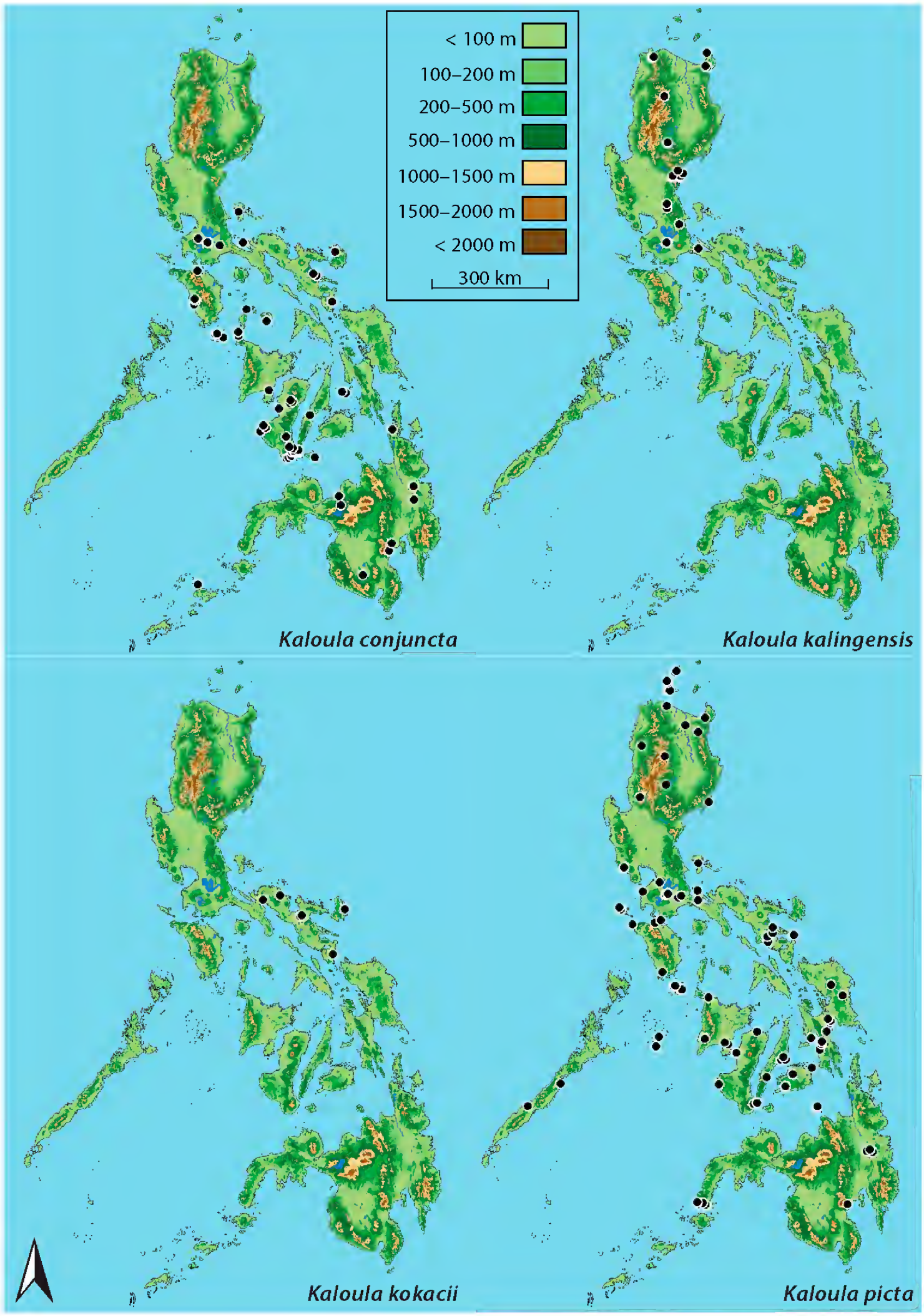

FIGURE 19. Geographic range maps for members of the family Microhylidae (*Kaoula conjuncta*, *K. kalingensis*, *K. kokacii*, and *K. picta*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

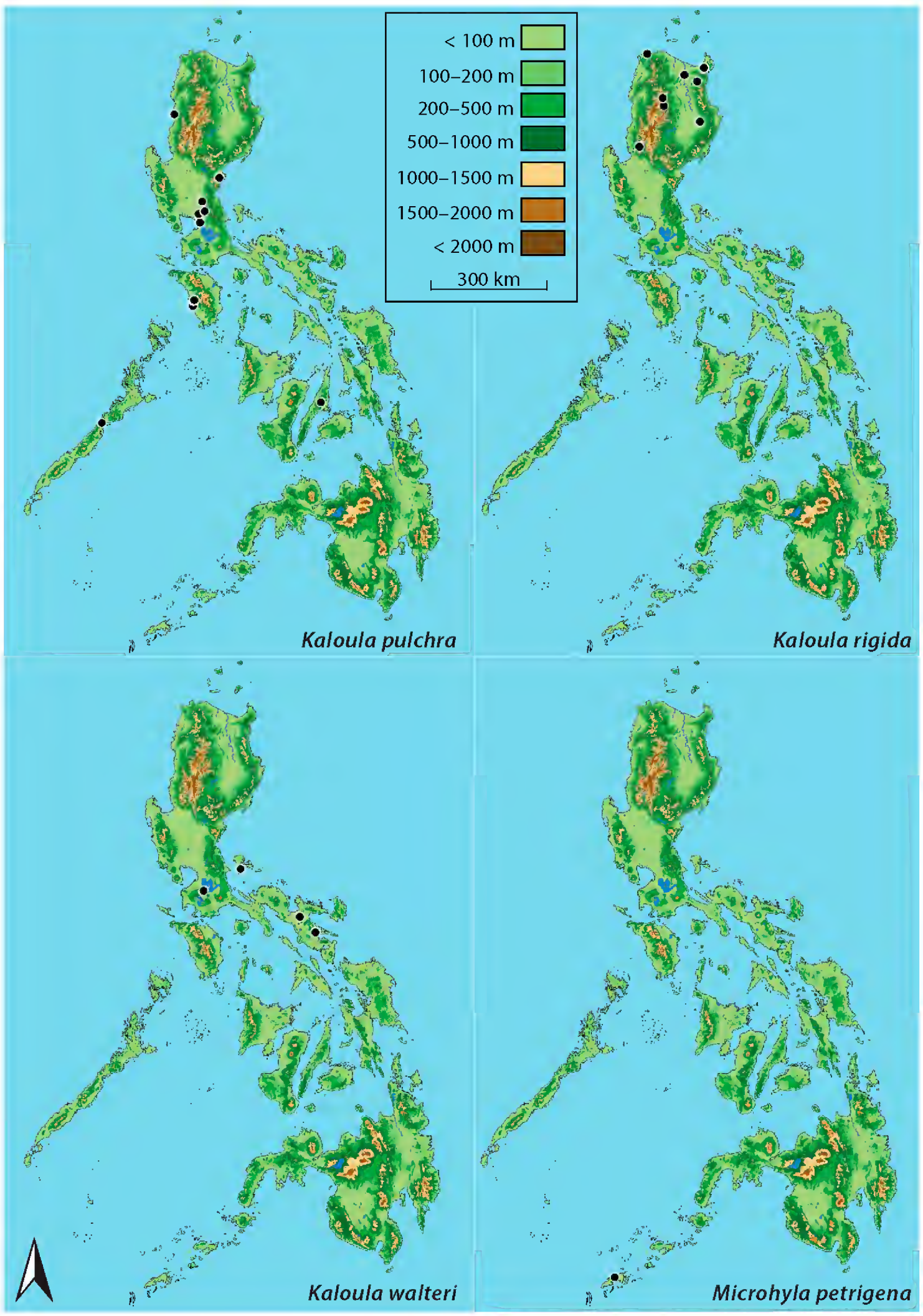

FIGURE 20. Geographic range maps for members of the family Microhylidae (*Kaloula pulchra*, *K. rigida*, *K. walteri*, and *Microhyla petrigena*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

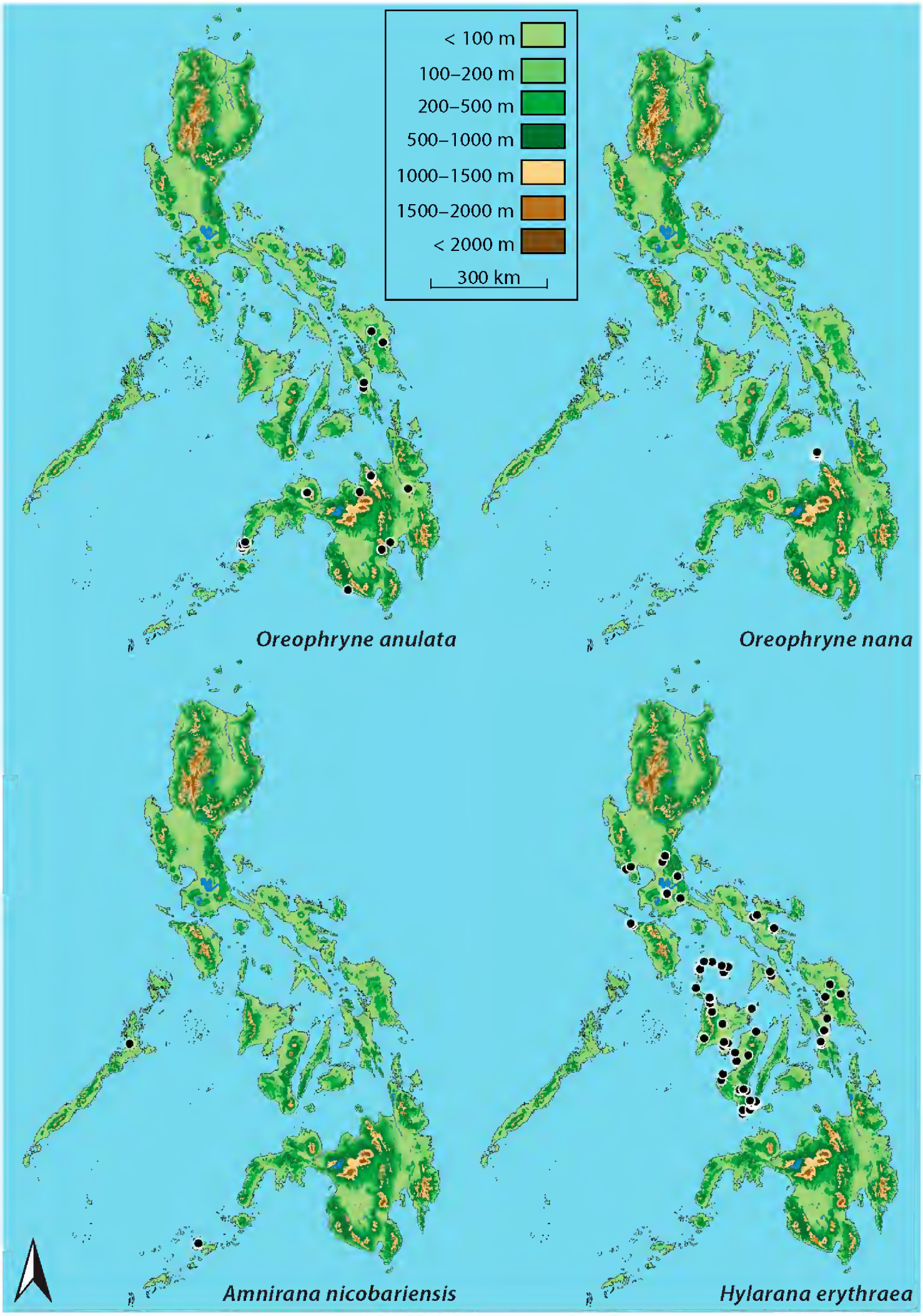

FIGURE 21. Geographic range maps for members of the families Microhylidae (*Oreophryne anulata* and *O. nana*), and Ranidae (*Amnirana nicobariensis* and *Hylarana erythraea*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

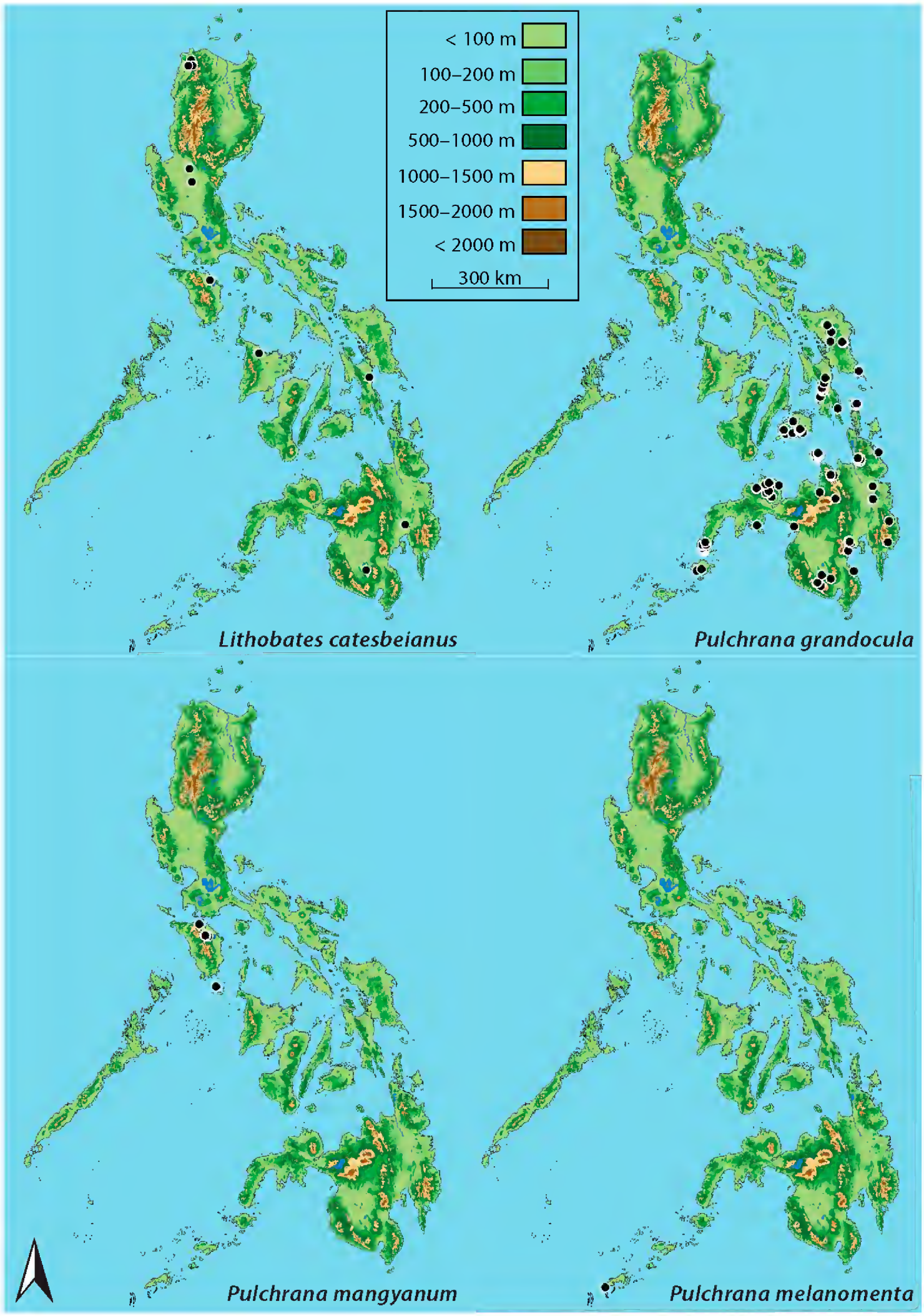

FIGURE 22. Geographic range maps for members of the family Ranidae (*Lithobates catesbeianus*, *Pulchrana grandocula*, *P. mangyanum*, and *P. melanomenta*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

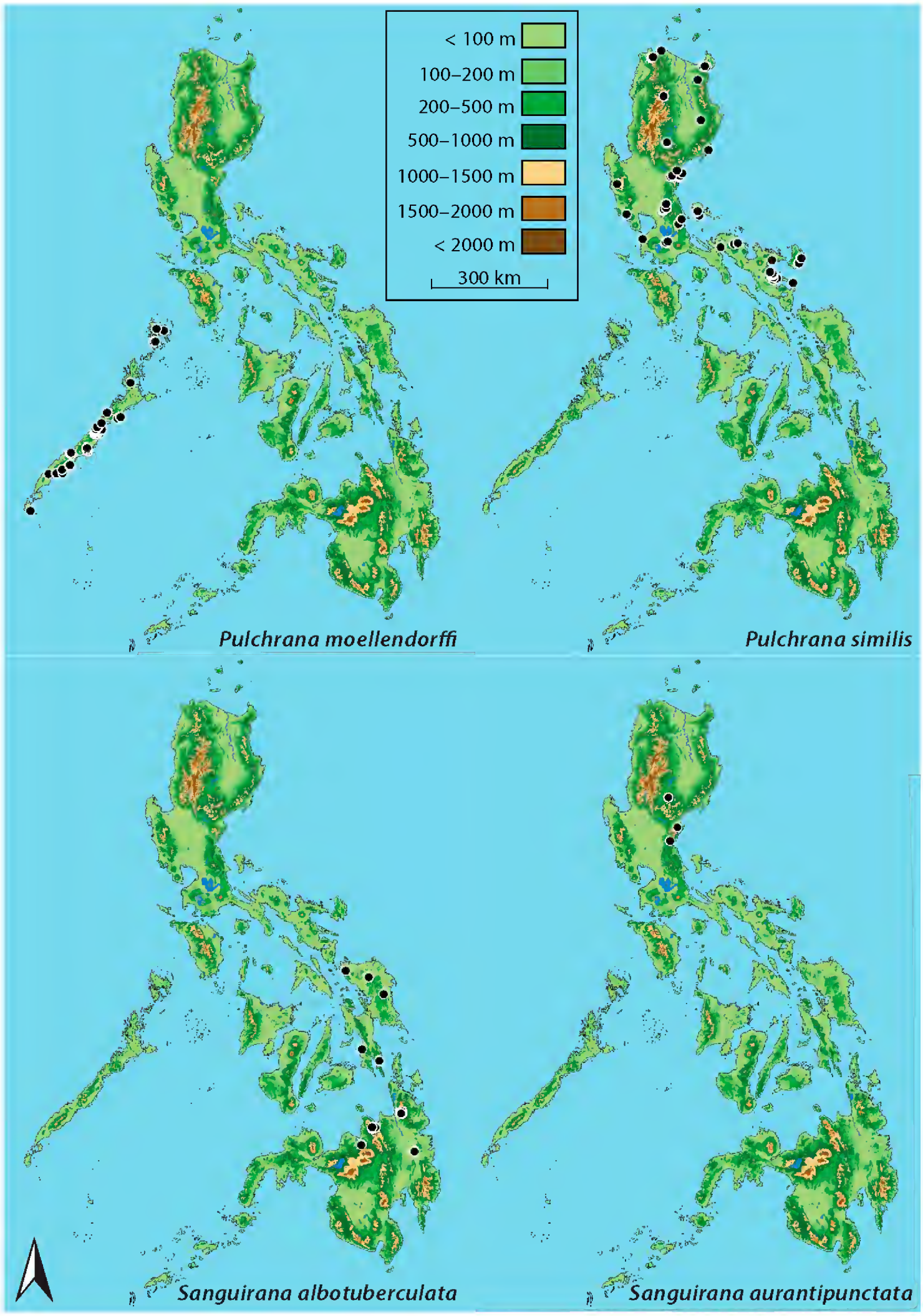

FIGURE 23. Geographic range maps for members of the family Ranidae (*Pulchrana moellendorffi*, *P. similis*, *Sanguirana albotuberculata*, and *S. aurantipunctata*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

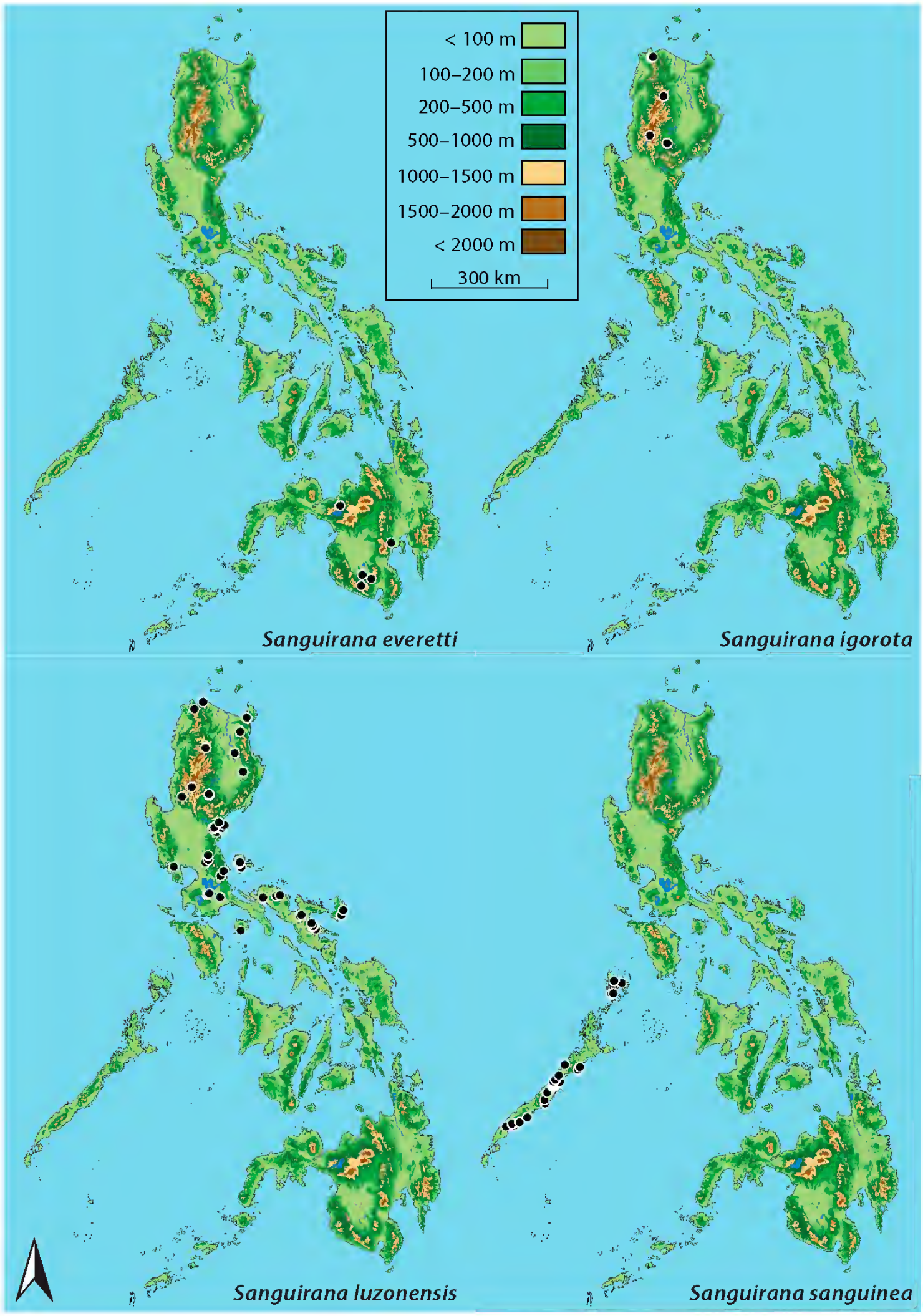

FIGURE 24. Geographic range maps for members of the family Ranidae (*Sanguirana everetti*, *S. igorota*, *S. luzonensis*, and *S. sanguinea*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

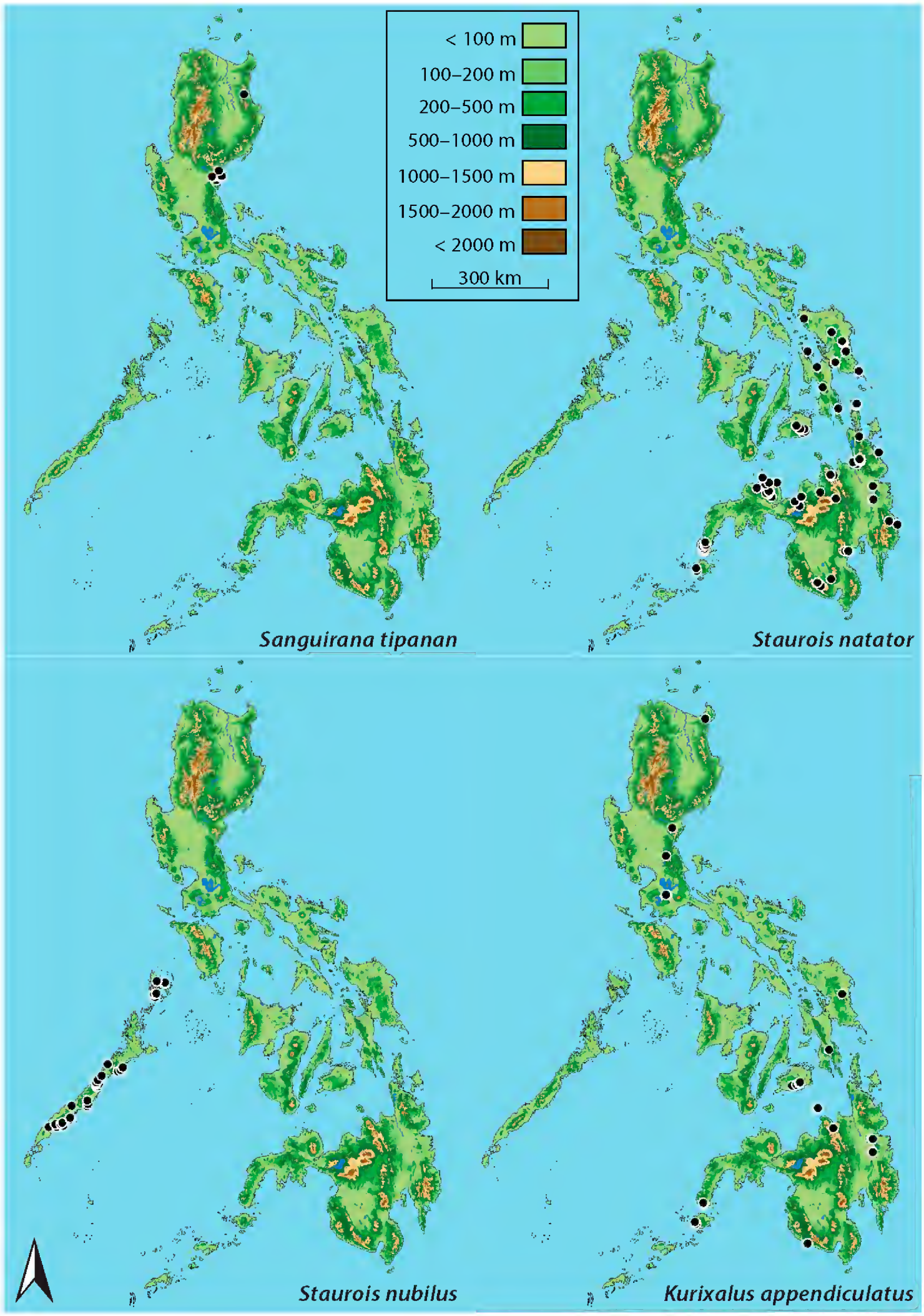

FIGURE 25. Geographic range maps for members of the families Ranidae (*Sanguirana tipanan*, *Staurois natator*, and *S. nubilus*), and Rhacophoridae (*Kurixalus appendiculatus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

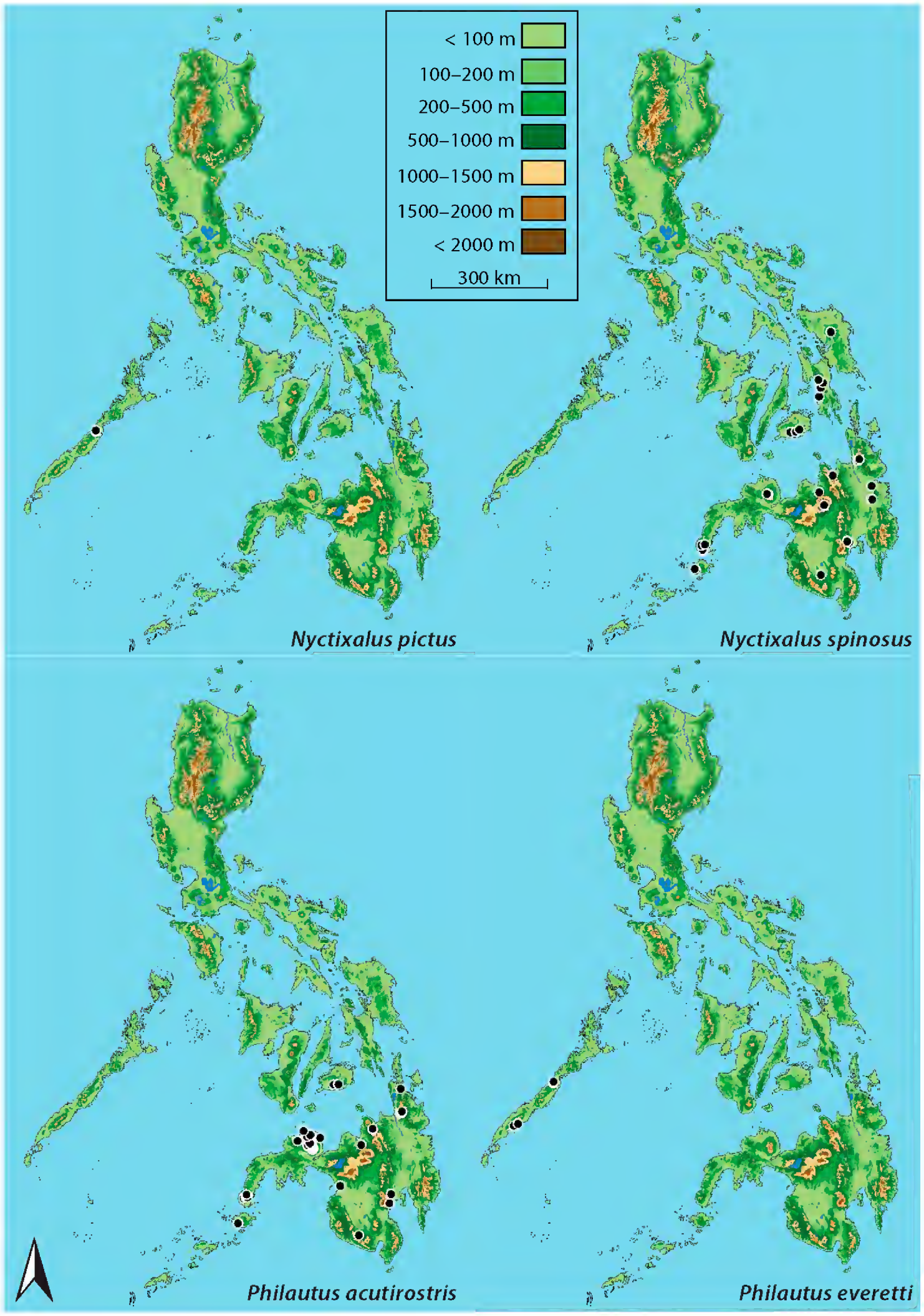

FIGURE 26. Geographic range maps for members of the family Rhacophoridae (*Nyctixalus pictus*, *N. spinosus*, *Philautus acutirostris*, and *P. everetti*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

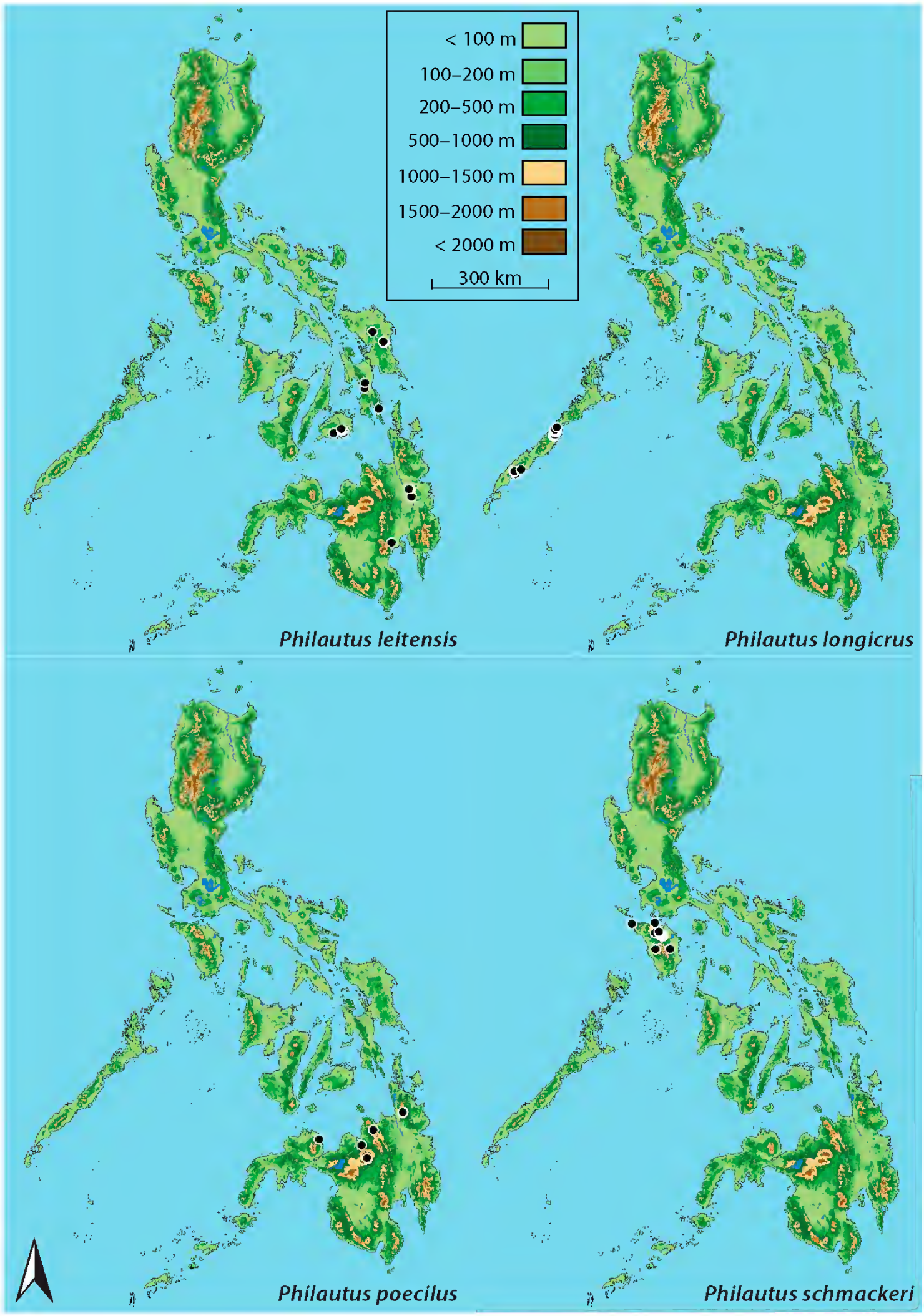

FIGURE 27. Geographic range maps for members of the family Rhacophoridae (*Philautus leitensis*, *P. longicrus*, *P. poecilus*, and *P. schmackeri*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

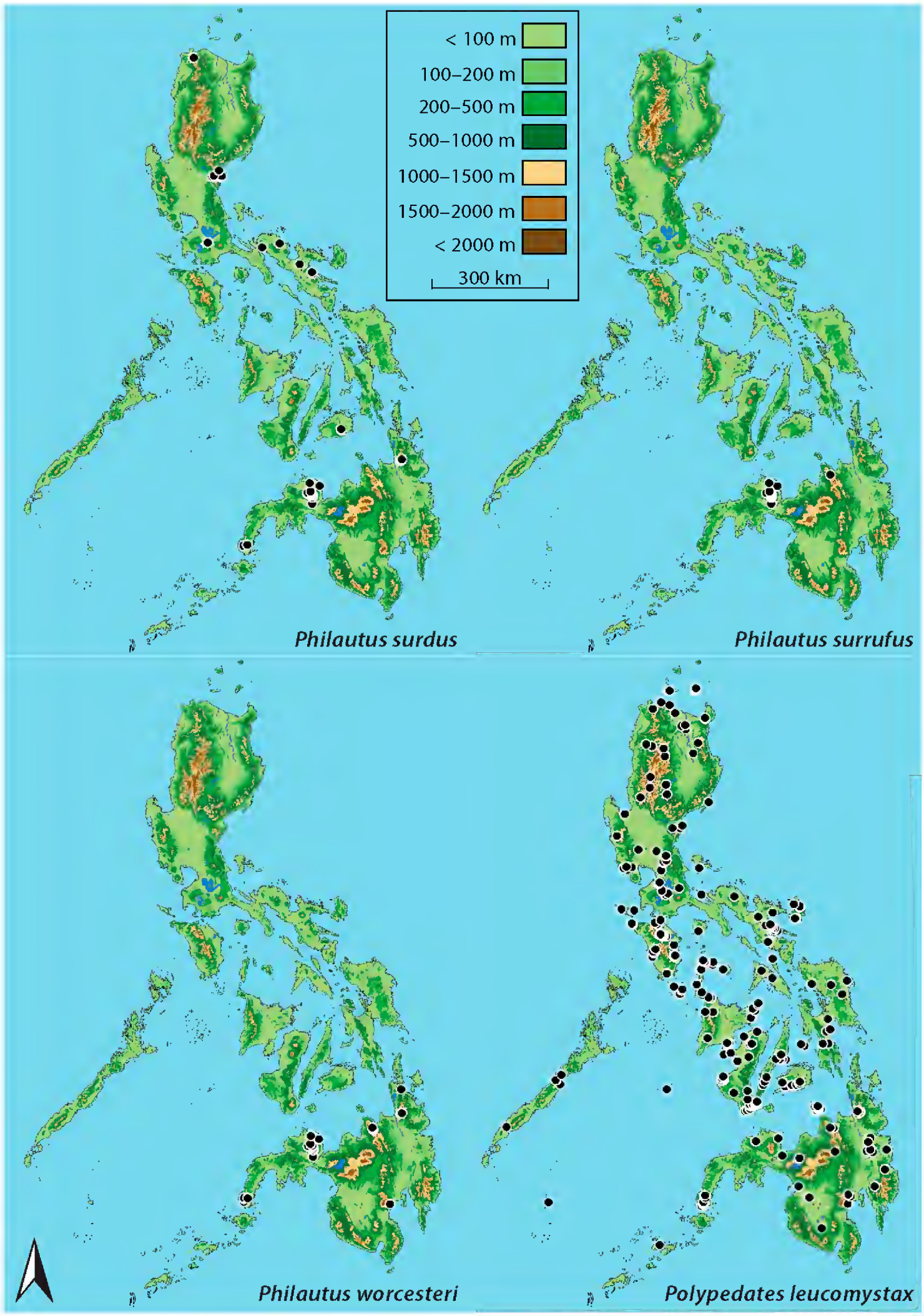

FIGURE 28. Geographic range maps for members of the family Rhacophoridae (*Philautus surdus*, *P. surrufus*, *P. worcesteri*, and *Polypedates leucomystax*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

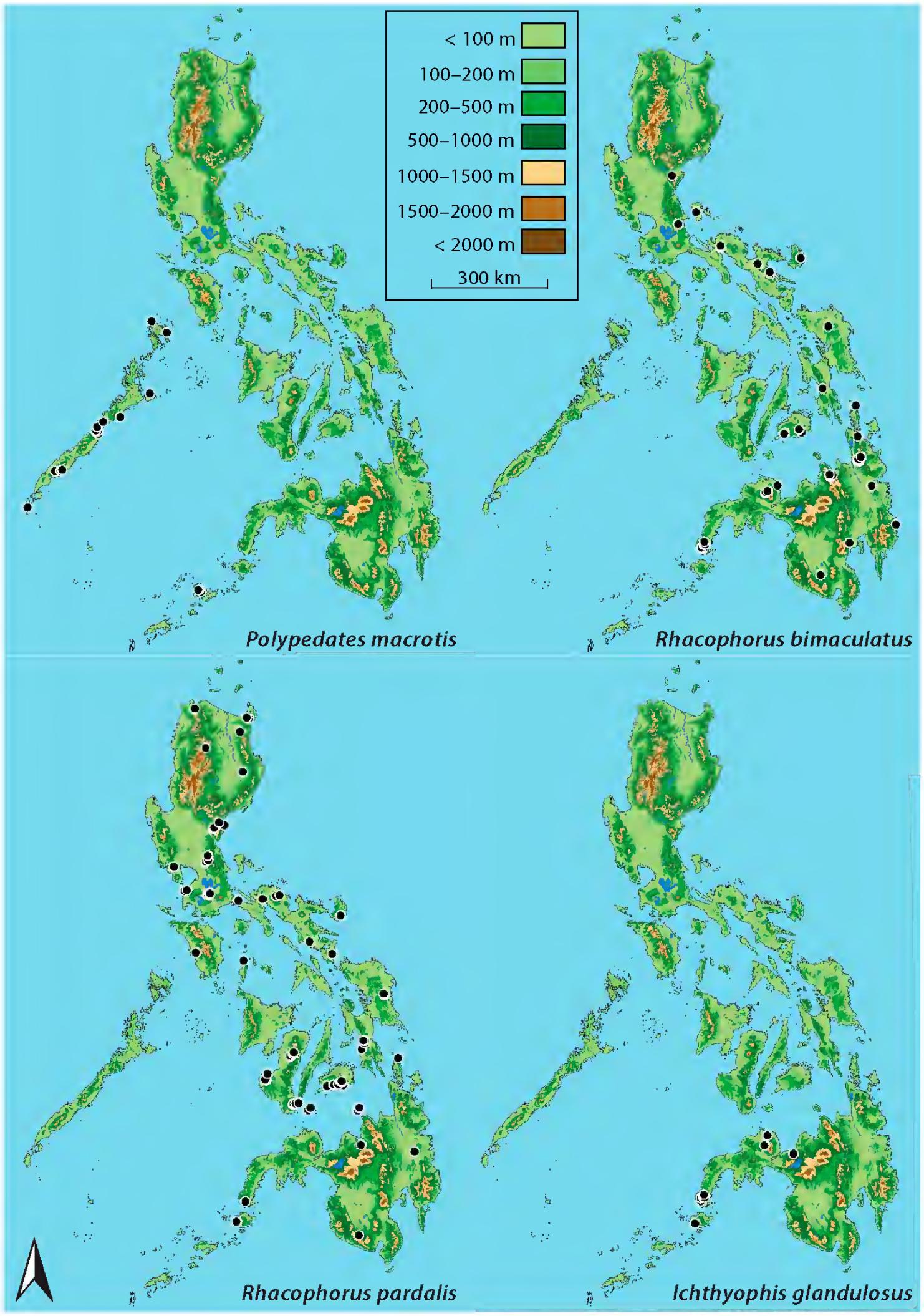

FIGURE 29. Geographic range maps for members of the families Rhacophoridae (*Polypedates macrotis*, *Rhacophorus bimaculatus*, and *R. pardalis*), and Ichthyophiidae (*Ichthyophis glandulosus*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

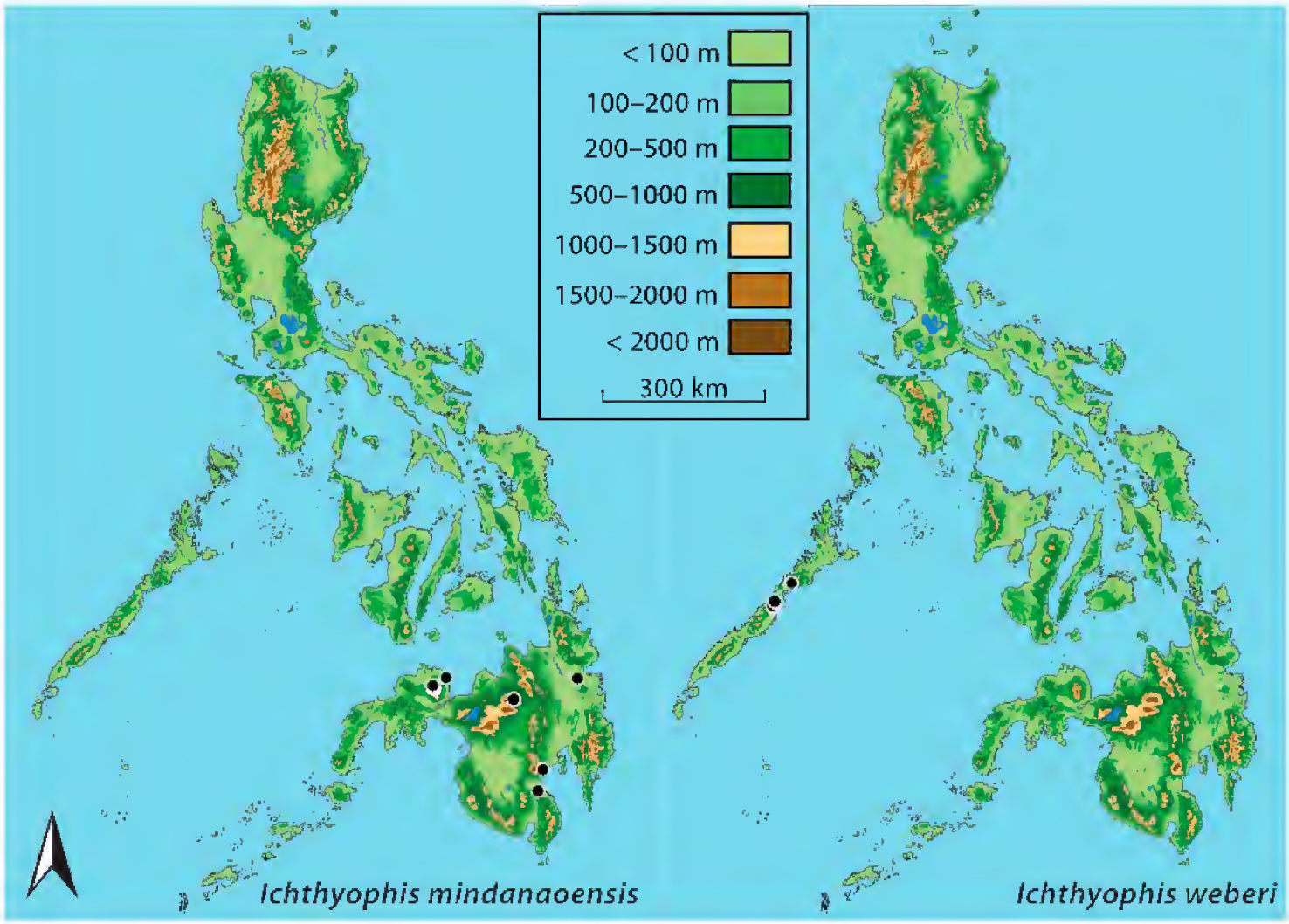

FIGURE 30. Geographic range maps for members of the family Ichthyophiidae (*Ichthyophis mindanaoensis* and *I. weberi*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

FIGURE 31. Photographs in life of A) *Barbourula busuangensis* (Bombinatoridae), B) *Ansonia mcgregori* (Bufonidae), C) *Ansonia muelleri* (Bufonidae), D) *Ingerophrynus philippinicus* (Bufonidae), E) *Pelophryne brevipes* (Bufonidae), F) *Pelophryne lighti* (Bufonidae), G) *Rhinella marina* (Bufonidae), and H) *Rhinella marina* (Bufonidae). Photographs copyright Rafe M. Brown (A), Janalee P. Caldwell (H), and Cameron D. Siler (B, C, D, E, F, G).

FIGURE 32. Photographs in life of A) *Platymantis banahao* (Ceratobatrachidae), B) *Platymantis bayani* (Ceratobatrachidae), C) *Platymantis biak* (Ceratobatrachidae), D) *Platymantis cagayanensis* (Ceratobatrachidae), E) *Platymantis cornutus* (Ceratobatrachidae), F) *Platymantis corrugatus* (Ceratobatrachidae), G) *Platymantis diesmosi* (Ceratobatrachidae), H) *Platymantis dorsalis* (Ceratobatrachidae). Photographs copyright Rafe M. Brown (A, D, E, G), Arvin C. Diesmos (C), and Cameron D. Siler (B, F, H).

FIGURE 33. Photographs in life of A) *Platymantis guentheri* (Ceratobatrachidae), B) *Platymantis hazelae* (Ceratobatrachidae), C) *Platymantis insulatus* (Ceratobatrachidae), D) *Platymantis isarog* (Ceratobatrachidae), E) *Platymantis lawtoni* (Ceratobatrachidae), F) *Platymantis levigatus* (Ceratobatrachidae), G) *Platymantis luzonensis* (Ceratobatrachidae), and H) *Platymantis montanus* (Ceratobatrachidae). Photographs copyright Rafe M. Brown (C, D, G, H), Jason Fernandez (E), and Cameron D. Siler (A, B, F).

FIGURE 34. Photographs in life of A) *Platymantis negrosensis* (Ceratobatrachidae), B) *Platymantis paengi* (Ceratobatrachidae), C) *Platymantis polillensis* (Ceratobatrachidae), D) *Platymantis pygmaeus* (Ceratobatrachidae), E) *Platymantis rabori* (Ceratobatrachidae), F) *Platymantis sierramadrensis* (Ceratobatrachidae), G) *Platymantis spelaeus* (Ceratobatrachidae), and H) *Platymantis subterrestris* (Ceratobatrachidae). Photographs copyright Rafe M. Brown (D, F, H) Cameron D. Siler (A, B, E, G), and Luke Welton (C).

FIGURE 35. Photographs in life of A) *Platymantis taylori* (Ceratobatrachidae), B) *Alcalus mariae* (Ceratobatrachidae), C) *Fejervarya moodiei* (Dicroglossidae), D) *Fejervarya vittigera* (Dicroglossidae), E) *Hoplobatrachus rugulosus* (Dicroglossidae), F) *Limnonectes acanthi* (Dicroglossidae), G) *Limnonectes leytensis* (Dicroglossidae), and H) *Limnonectes macrocephalus* (Dicroglossidae). Photographs copyright Rafe M. Brown (B, H), Arvin C. Diesmos (A, E), Cameron D. Siler (C, D, G), and Scott Travers (F).

FIGURE 36. Photographs in life of A) *Limnonectes magnus* (Dicroglossidae), B) *Limnonectes palavanensis* (Dicroglossidae), C) *Limnonectes parvus* (Dicroglossidae), D) *Limnonectes visayanus* (Dicroglossidae), E) *Limnonectes woodworthi* (Dicroglossidae), F) *Occidozyga diminutiva* (Dicroglossidae), G) *Occidozyga laevis* (Dicroglossidae), and H) *Leptobrachium lumadorum* (Megophryidae). Photographs copyright Rafe M. Brown (A, B, C, D, F) and Cameron D. Siler (E, G).

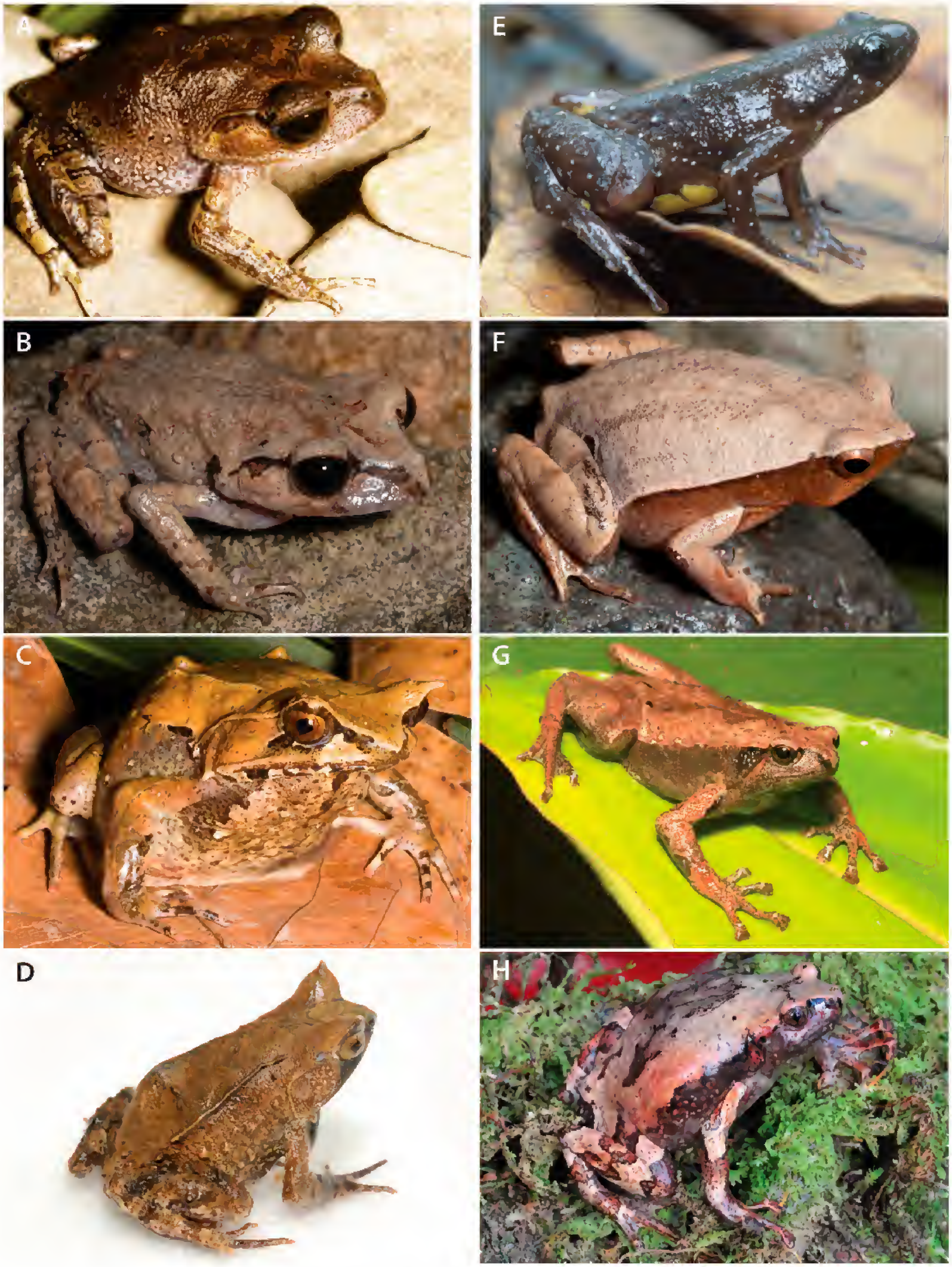

FIGURE 37. Photographs in life of A) *Leptobrachium mangyanorum* (Megophryidae), B) *Leptobrachium tagbanorum* (Megophryidae), C) *Megophrys ligayae* (Megophryidae), D) *Megophrys stejnegeri* (Megophryidae), E) *Chaperina fusca* (Microhylidae), F) *Kalophrynus sinensis* (Microhylidae), G) *Kaloula conjuncta* (Microhylidae), and H) *Kaloula kalingensis* (Microhylidae). Photographs copyright Rafe M. Brown (A, B, C, E, F), Arvin C. Diesmos (D), Cameron D. Siler (H), and Scott Travers (G).

FIGURE 38. Photographs in life of A) *Kaloula picta* (Microhylidae), B) *Kaloula pulchra* (Microhylidae), C) *Kaloula rigida* (Microhylidae), D) *Kaloula walteri* (Microhylidae), E) *Microhyla petrigena* (Microhylidae), F) *Oreophryne anulata* (Microhylidae), G) *Oreophryne nana* (Microhylidae), and H) *Hylarana erythraea* (Ranidae). Photographs copyright Rafe M. Brown (C, D, F), Arvin C. Diesmos (E), Cameron D. Siler (A, G, H), and Scott Travers (B).

FIGURE 39. Photographs in life of A) *Lithobates catesbeianus* (Ranidae), B) *Pulchrana granocula* (Ranidae), C) *Pulchrana mangyanum* (Ranidae), D) *Pulchrana moellendorffi* (Ranidae), E) *Pulchrana similis* (Ranidae), F) *Sanguirana albotuberculata* (Ranidae), G) *Sanguirana aurantipunctata* (Ranidae), and H) *Sanguirana everetti* (Ranidae). Photographs copyright Rafe M. Brown (D, G), Janalee P. Caldwell (A), and Cameron D. Siler (B, C, E, F, H).

FIGURE 40. Photographs in life of A) *Sanguirana igorota* (Ranidae), B) *Sanguirana luzonensis* (Ranidae), C) *Sanguirana sanguinea* (Ranidae), D) *Sanguirana tipanan* (Ranidae), E) *Staurois natator* (Ranidae), F) *Staurois nubilus* (Ranidae), G) *Kurixalus appendiculatus* (Rhacophoridae), and H) *Nyctixalus spinosus* (Rhacophoridae). Photographs copyright Rafe M. Brown (A, C, D, F) and Cameron D. Siler (B, E, G, H).

FIGURE 41. Photographs in life of A) *Nyctixalus spinosus* (Rhacophoridae), B) *Philautus acutirostris* (Rhacophoridae), C) *Philautus everetti* (Rhacophoridae), D) *Philautus leitensis* (Rhacophoridae), E) *Philautus longicrus* (Rhacophoridae), F) *Philautus poecilus* (Rhacophoridae), G) *Philautus surdus* (Rhacophoridae), and H) *Philautus worcesteri* (Rhacophoridae). Photographs copyright Rafe M. Brown (B, C, E, F, H) and Cameron D. Siler (A, D, G).

FIGURE 42. Photographs in life of A) *Polypedates leucomystax* (Rhacophoridae), B) *Polypedates macrotis* (Rhacophoridae), C) *Rhacophorus bimaculatus* (Rhacophoridae), D) *Rhacophorus pardalis* (Rhacophoridae), E) *Ichthyophis glandulosus* (Ichthyophiidae), and F) *Ichthyophis glandulosus* (Ichthyophiidae). Photographs copyright Rafe M. Brown (B, E, F) and Cameron D. Siler (A, C, D).

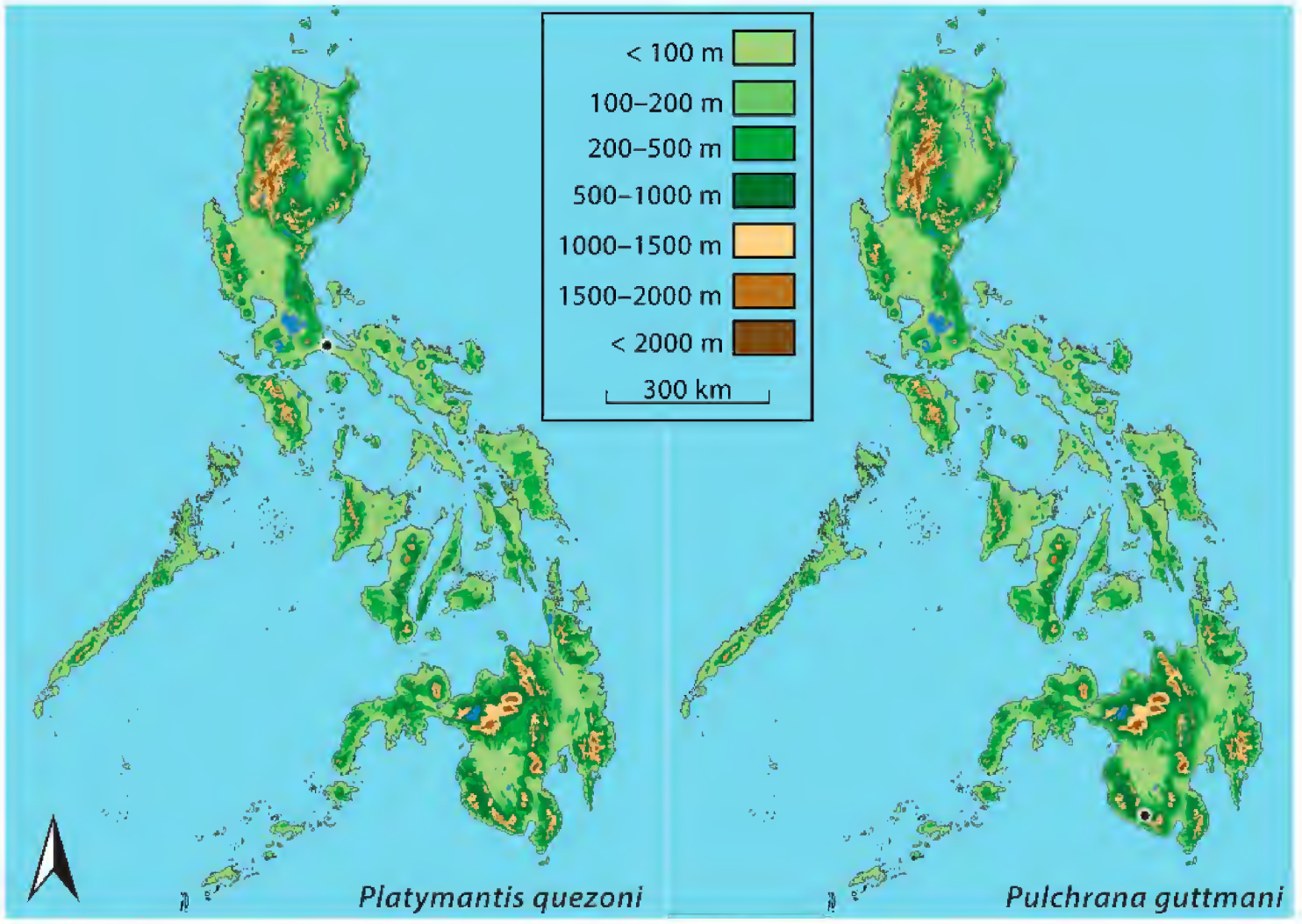

FIGURE 43. Geographic range maps for members of the families Ceratobatrachidae (*Platymantis quezoni*) and Ranidae (*Pulchrana guttmani*). Points represent museum vouchered specimens with georeferenced locality information overlaid on a topographic map of the Philippines.

FIGURE 44. Photograph in life of (A) *Platymantis quezoni* (Ceratobatrachidae). Photograph copyright Rafe M. Brown.

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Species of *Macromitrium* (Orthotrichaceae) New to the Mindanao Region and the Philippines with One Species New to Science

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Numerous collections of *Macromitrium* were made during a joint expedition between the California Academy of Sciences and the Central Mindanao State University in 2014 and 2015 from the region of Mindanao in the Philippines. Two *Macromitrium* species collected from the Mindanao Region are new records for the Philippine flora, along with a species, *M. eddyi*. Range extensions of four species of *Macromitrium* across the island of Mindanao are mentioned. A review of the species diversity of *Macromitrium* between the Luzon Island region and the Mindanao region is also provided.

KEYWORDS: Asian mosses, bryophyte inventory, Malesia, Mindanao Island, new records, Papua New Guinea, Philippines, species distribution

Mindanao Island (ca 104,630 km^2) and its off shore, small islands, although slightly smaller than and ranking second in total land area next to Luzon Island (ca 109,965 km^2), have only half the number of moss species documented for the latter (Linis and Tan 2008). However, recent reports of collecting activities of mosses of Mindanao Island have added 60 new species records to the island (Tan and Shevock, 2014; Azuelo et al. 2015; Tan et al. 2015). Here we focus our study on the epiphytic moss genus, *Macromitrium* Brid., which has a different assemblage of species occurring on these two major Philippine island groups.

Early in this century, 21 species of *Macromitrium* were documented from the Philippines with 18 species reported from Luzon and 13 species from Mindanao (see Tan and Iwatsuki 1991; Tan et al. 2000). The two new expeditions organized by the California Academy of Sciences and the CEBREM Office of Central Mindanao State University in 2014 and 2015 have added three new records of *Macromitrium* (Tan et al. 2015; this publication), and one reported below as a species new to science.

An updated list of the 19 species and one variety of *Macromitrium* in Mindanao is appended below based on Tan et al. (2000), Linis (2010), Tan et al. (2015) and this publication. Of these, *M. archboldii* E.B. Bartram, *M. eddyi* B.C. Tan & Shevock sp. nov., *M. mindorense* Broth., *M. ochraceum* (Dozy & Molk.) Müll. Hal. and *M. tylostomum* Mitt. ex Bosch & Sande Lac. are not documented from Luzon Island. On the other hand, *M. benguetense* Williams, *M. fasciculare* Mitt., *M. formosae* Card., *M. nepalense* (Hook. & Grev.) Schwägr., and *M. robinsonii* Williams still have no specimens found in Mindanao. It is noteworthy that Luzon has received considerably more bryophyte inventory work since it is within the Manila area compared to distant Mindanao. We speculate that additional Wallacea-Australian *Macromitrium* are unlikely to occur in the northern

half of the Philippine archipelago based on this collection history. However, we expect additional *Macromitrium* species documented from either adjacent Indonesia or Papua New Guinea could be discovered in Mindanao with additional field inventory.

New Species

Dr. Alan Eddy (1937–1998), while affiliated with the herbarium of the British Museum (BM), was working on a multi-volumed *Handbook of Malesian Mosses* up to the time of his death. The third and final fascicle he published includes the moss family Orthotrichaceae (Eddy 1996). *Macromitrium* is a very large and complex genus with over 350 species (Crosby et al. 2000). During the development of the *Macromitrium* treatment he encountered a single specimen that could not be assigned to any of the known Malesian species. He decided to include this specimen and reference it simply as '*Macromitrium* sp.' with the hope that other bryologists would eventually encounter it. Therefore, he was the first person to recognize this *Macromitrium* as likely to be new to science. Although he decided not to name it as a new species based on a single sample, he nonetheless provided a detailed description (p. 38) and prepared an illustration (fig. 350) of this taxon based on the specimen labeled as "*Stevens no. 55716*" (see Eddy 1996). While examining our recently collected *Macromitrium* collections from Mindanao, we used the *Macromitrium* key in Eddy (1996) and realized that one of our unknown specimens matched the illustration and description entry as '*Macromitrium* sp.' We borrowed this collection from BM and compared it to the Philippine specimen (*Shevock 44672*) from Mt. Kitanglad Range Natural Park. We determined the species to be one and the same.

***Macromitirum eddyi* B. C. Tan & Shevock, sp. nov.**

Figures 1–3.

Holotype: **Papua New Guinea**: Milne Bay District, Raba-Raba Sub-district, bottom of scarp of Tantam Plateau, Mt. Suckling, 1645 m., in shaded forest, common on wood, 20 Jul 1972, coll. *P.F. Stevens* [*LAE 55716*] (BM!; isotypes, CANB, E, L, LAE). Paratype: **Philippines**: **Mindanao Island**: Bukidnon Province, on access dirt road to trail less than 0.5 km above Lantapan Village toward Mt. Dulang-Dulang in Kitanglad Range Natural Park, on trunk of *Gmelina* in disturbed forest near cultivated field, 20 Apr 2014, *Shevock 44672* (CAS; isoparatype, CMUH, NY, UC).

The new species can be identified easily using the key to the species of *Macromitrium* published in Eddy (1996). Morphologically the new species is identified by its slender and long branches with leaves arranged in five straight, longitudinal rows, when wet. Other diagnostic characters include leaves with acute to acuminate apices, percurrent to shortly excurrent costae, papillose upper leaf cells, and tuberculate lower leaf cells. In addition, the basal leaf cells are thick-walled with straight to curved lumina.

Below we reproduce verbatim the species description prepared by Eddy (1996) in whose honor we name this new species in recognition of his great contribution to our knowledge of Malesian mosses. Additionally, we include herewith photographs of the specimen of the Philippine paratype to complement the nice illustration of what is now *M. eddyi* that appears in Eddy (1996).

"Plants yellowish, slender, with elongate, sparingly ramifying branches up to 5 cm long. Leaves closely set, squarrose-recurved and markedly pentastichous when moist, erect and appressed with crisped upper limbs when dry, rendering the branches string-like in appearance; triangular lanceolate, canaliculate, finely acuminate, up to 3 mm long; apex finely acute, pellucid. Costa percurrent to short excurrent. Upper lamina cells small, isodiametric, ca 6–9 μm diameter, densely pluripapillose and obscure; lower lamina cells elongate with strongly thickened walls and

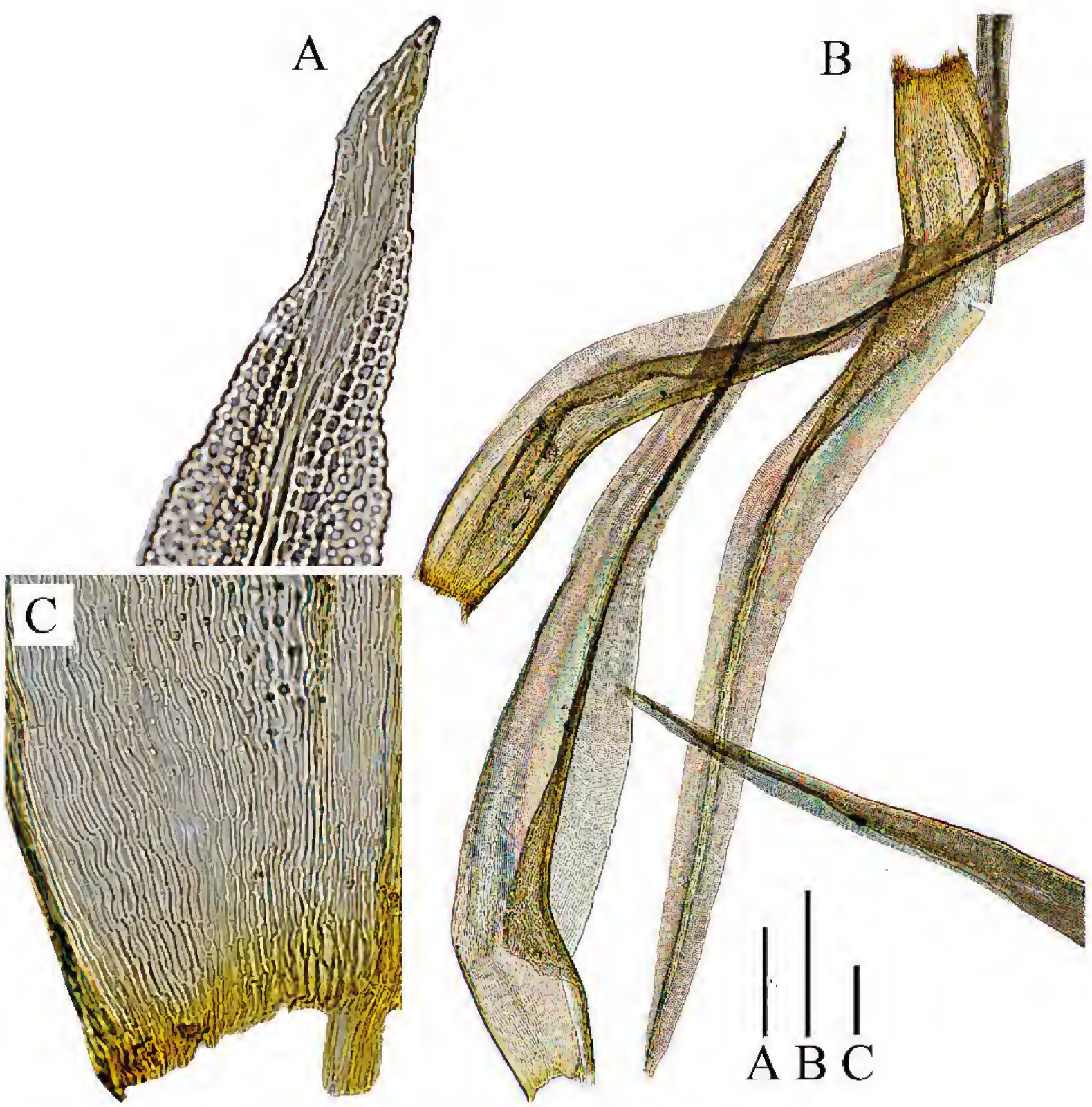

FIGURE 1. *Macromitrium eddyi* B.C. Tan & Shevock from the holotype, *Stevens 55716* (BM). A. Leaf apex with percurrent costa of elongate cells and upper laminal cells multipapillose. B. Leaves. C. Lower laminal cells elongate with thickened walls and narrow, straight to somewhat curved lumina cells conspicuously tuberculate. Scale bars: A, C: 5 µm, B. 0.5 mm.

FIGURE 2. Habit of *Macromitrium eddyi* stems in a dry state. *Shevock 44672* (CAS).

FIGURE 3. Growth habit of *Macromitrium eddyi* from *Shevock 44672* (CAS).

narrow, straight lumina, conspicuously tuberculate. Perichaetial leaves narrowly triangular-lanceolate, plicate, very finely acuminate and filiform-pointed. Seta short, about 3 mm long, smooth; capsule ovoid, smooth, small, the urn about 1 mm long and 0.8 mm wide; peristome of pale, rather fugacious, triangular exostome teeth; calyptra naked."

New Species Records for the Philippines

Macromitrium tylostomum Mitt. ex Bosch & Sande Lac.

Specimen examined:— **Mindanao Island**: North Cotabato Province: Mt. Apo, trail to Plot H of EDC, ca 1900 m, 29 Apr 2014, *Tan 2014-132* (CAS, UC).

Among members of *Macromitrium* in the Philippines, this is one of three species that have the laminal cells rounded to quadrate in shape from apex to near base. It differs from the other two species, *M. orthostichum* Nees ex Schwägr. and *M. falcatulum* Müll. Hal. in having smooth and not papillose basal laminal cells. Although the upper and middle laminal cells are smooth, thin-walled and budging, the basal laminal cells of *M. tylostomum* are thick-walled and decorated with tall papillae. The cylindrical capsule attached to a short, smooth seta is also distinctive. Outside of the Philippines, *M. tylostomum* is known from Java, Sumatra and Papua New Guinea.

Macromitrium yuleanum Broth. & Geheeb

Specimens examined:— **Mindanao Island**: Bukidnon Province: Mt. Kitanglad Range Natural Park, midslope of Mt. Dulan-Dulang Peak along the ridge trail separating headwaters of Alanib River and Magnao River, on fallen branch in mixed hardwood forest, 21–23 Apr 2014, *Shevock 44727, 44779, 44842* (CAS, CMUH, NY, UC).

According to Vitt et al. (1995), this is the most common, large sized and variable species of *Macromitrium* at high elevation in Huon Peninsula of Papua New Guinea and has been described as a new species at least seven times. The Mindanao collections cited above fit well with the species description presented in Vitt et al. (1995). They differ mainly in having widely erect-spreading (not squarrose-recurved) leaves when wet, more narrowly acuminate leaf apices, and a calyptra with noticeably stiff and long hair.

Macromitrium yuleanum is best identified by its narrowly ovate-lanceolate to oblong lanceolate leaves with percurrent to short, excurrent costa, and a weakly differentiated border of 1 to 2 rows of short rectangular, smooth cells near the denticulate apex and along the margins of the upper half of leaf. The laminal cells vary from mammillose to unipapillose. The setae are long, reaching more than 15 mm. The perichaetial leaves have a very long excurrent costa, nearly of the same length of lamina in some leaves.

Among the local congeners, *M. longicaule* Müll. Hal. is most similar in plant habit and leaf characters to *Macromitrium yuleanum*, but the former has percurrent leaf costa and short seta less than 5 mm long. Likewise, the somewhat look-alike *M. macrosporum* Broth. differs from *M. yuleanum* in having the percurrent leaf costa that ends at an incurved and entire apex. The leaf cells are nearly smooth and only slightly mammillose, but not unipapillose like in some leaves of *Macromitrium yuleanum*. The calyptra of *M. macrosporum* is also smooth with no hairs. *Macromitrium yuleanum* can also be mistaken for *M. ochraceum*, which is more commonly encountered in Mindanao Island. According to Eddy (1996), it can be separated from the latter by its less acute and shorter leaf apices with setae twice as long as that of *M. ochraceum*.

Macromitrium yuleanum was previously viewed as an endemic species of New Guinea and Solomon Islands.

***Macromitrium blumei* Nees ex Schwägr. [syn. *M. zollingeri* Dozy & Molk.; *M. blumei* var. *zollingeri* (Mitt. ex Bosch & Sande Lac.) S. L. Guo, B. C. Tan & Virtanen]**

SPECIMENS EXAMINED:— **Mindanao Island**: Bukidnon Province, saddle below the summit of Mt. Dulang-Dulang in Mt. Kitanglad Range Natural Park, on branches, 24 Apr 2014, *Shevock & B.C. Tan 44874* (CAS, CMUH, UC); ibid, Mt. Kiamo, along ridge trail to summit, on fallen hardwood branch, 7 May 2014, *Shevock & B.C. Tan 45141* (CAS, CMUH, UC); ibid, Mt. Limbawon, trail along ridge top at 1885 m elev. from campsite about 9 km distance above Kibalabag village, on branch of *Dacrydium* in open site of montane forest, 30 Jun 2015, *Shevock et al. 47042* (CAS, CMUH, UC); Davao Oriental Province, along trail from Camp 2 near pygmy forest to summit of Mt. Hamiguitan, 1175–1350 m elev., on small diameter tree trunk in sun, 22 Jun 2015, *Shevock & Yorong 46903, 46912* (CAS, CMUH, UC).

This is a common species in the Philippines and also a widespread member of the genus in Malesia. On Mindanao Island, it has been reported only from Mt. Candoon in Bukidnon Province and Mt. Apo Natural Park. The collections cited above expand the distribution of this species in Mindanao.

Macromitrium blumei is interpreted by us as a polymorphic species that exhibits both smooth and strongly bulging upper leaf cells. The synonymy between *M. blumei* and *M. zollingeri* was suggested by Eddy (1996) and agreed by us after we examined many packets of Mindanao specimens of these two taxa. The coiling leaves around the short branches, when dry, give the shoot a characteristic rope-like appearance (Eddy 1996). The small plant size, coupled with a somewhat asymmetrically obtuse leaf apex and a short to moderately long, excurrent costa, are additional diagnostic characters of this species. *Macromitrium blumei* is a widespread and common species in Malesia.

***Macromitrium cuspidatum* Hampe**

SPECIMENS EXAMINED:— **Camiguin Island**: Municipality of Mambajao, Mt. Hibok-Hibok, along Tagdo Trail to the summit at 710 m elev., on tree trunk in filtered sunlight, 8 Jul 2015, *Shevock & B.C. Tan 47157* (CAS, CMUH, UC). **Mindanao Island**: Davao Oriental Province, along trail from Camp 2 near pygmy forest to summit of Mt. Hamiguitan, 1040 m elev., on tree trunk in filtered sunlight, 22 Jun 2015, *Shevock & Yorong 46898* (CAS, CMUH, UC); ibid, along trail from Camp 2 to Twin Falls, mid-slope of Mt. Hamiguitan, 900–960 m elev., on tree trunk in filtered sunlight, 23 Jun 2015, *Shevock & Yorong 46937, 46953* (CAS, CMUH, UC).

This is a distinctive species of *Macromitrium* in the Philippine moss flora and can be easily identified by the nearly all oblong to elongate and smooth leaf cells, coupled with a long excurrent costa. The plants are yellowish green in color and moderately large in size, which make the sporophyte look small in comparison. It has been reported from many places in island groups of Luzon, Mindoro, Palawan and Visayan Region (Tan and Iwatsuki 1991), but not from Mindanao Island until a report on the mosses of Mt. Kiamo in Bukidnon Province, was published by Tan et al. (2015). The above cited collections provide a north and south distribution range extension across Mindanao Island. *Macromitrium cuspidatum* is a widespread species in Malesia but not as commonly encountered as *M. blumei*.

***Macromitrium microstomum* (Hook. & Grev.) Schwägr. [syn. *M. reinwardtii* Schwägr.]**

SPECIMEN EXAMINED:— **Mindanao Island**: North Cotabato Province, Mt. Apo, toward Lake

Ma-ag above the Geothermal Production Field of EDC, 1 May 2014, *Shevock 45012* (CAS, CMUH, UC).

According to Eddy (1996) and Vitt et al. (1995), this species is characterized by having smooth and flat lamina cells throughout the leaf, ovoid capsules borne on a long seta reaching often to 1.5 cm, and a naked, plicate calyptra.

Macromitrium microstomum, had been known earlier from the Philippines by its synonym, *M. reinwardtii*, and had already been reported from Luzon, Mindoro, and some islands in the Visayan Region (Tan and Iwatsuki, 1991); we now add Mindanao to the list. Otherwise, *Macromitrium microstomum* is widespread throughout tropical SE Asia reaching Australia, New Zealand, and Oceania. It is known also from Mexico, Guatemala, Costa Rica and the Caribbean Islands (Vitt et al. 1995).

***Macromitrium ochraceum* (Dozy & Molk.) Müll. Hal.**

Specimens examined:— **Mindanao Island**: Bukidnon Province, Mt. Kiamo, along ridge trail to summit in mixed hardwood-podocarp shrubland, on small tree trunk, 7 May 2014, *Shevock & B.C. Tan 45171* (CAS, CMUH, UC); ibid, Mt. Limbawon, trail along ridge top at 1800–1885 m elev. from campsite about 8–9 km distance above Kibalabag village, on ground and branch of *Dacrydium* in open site of montane forest along a cascading stream, 30 Jun 2015, *Shevock et al. 47037, 47041* (CAS, CMUH, UC); Davao Oriental Province, Mt. Hamiguitan, volcanic rock wall, 22 Jun 2015, *Shevock & Yorong 46919* (CAS, CMUH, UC), hardwood branch, 24 Jun 2015, *Shevock 46972* (CAS, CMUH).

Although this species is not new to Mindanao Island, it was previously known from only a single locality. These collections represent a distribution range extension of this large-sized *Macromitrium*. Bartram (1939) commented that "the long, ruddy, sparingly branched secondary stems and the very rough setae quickly establish the identity of *M. ochraceum*". According to Vitt et al. (1995), its smooth to slightly bulging, upper laminal cells and the narrowly elongate, straight, thick-walled and tuberculate basal leaf cells add to its species distinctiveness. A good illustration of this species appears in Eddy (1996).

On Mindanao, *M. ochraceum* is rather variable in its plant size, and, thus, also the coarseness of its stems. In herbarium collections, specimens of *M. ochraceum* are likely to be misidentified as *M. longicaule* Müll. Hal., which has a similarly large plant size, long branches, and curvy, dry leaf foliation. The former species however, has short and papillose setae less than 1 cm long, whereas the latter has smooth setae more than 1 cm long. The leaf cells of *M. ochraceum* are smooth to mamillose and bulging, not pluripapillose like the leaf cells of *M. longicaule*. *Macromitrium ochraceum* is a widespread species at higher elevations in Malesia.

Acknowledgments

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imaging system, Project Lab, California Academy of Sciences with credit given to the photographer Kathryn Whitney. Also, we again want to take note, with thankful appreciation, for the loan of Dr. Eddy's material labeled '*Macromitrium* sp.' by the British Museum (BM). Lastly, we gratefully acknowledge the thoughtful comments provided by Dr. Thomas Daniel who perused an early version of the manuscript and to two anonymous reviewers.

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Appendix I

List of 19 *Macromitrium* species and one variety reported for the Mindanao Region. An asterisk (*) indicates a new distribution record for a species reported in this publication, while two asterisks (**) indicate a species new to science.

Macromitrium angustifolium Dozy & Molk.— Camiguin Island: Mt. Timpoong, Mt. Hibok-Hibok (Linis, 2010).

Macromitrium archboldii E.B. Bartram — Mindanao Island: Mt. Kitanglad Natural Park (Tan et al. 2000).

Macromitrium blumei Nees *ex* Schwägr.— Mindanao Island: Mt. Candoon, Mt. Apo, Mt. Kitanglad Natural Park, Mt. Kiamo, Mt. Limbawon, Mt. Hamiguitan (Bartram, 1939; Tan and Iwatsuki, 1991; this publication).

Macromitrium cuspidatum Hampe — Mindanao Island: Mt. Kiamo, Mt. Hamiguitan (Tan et al. 2015); (this publication).

***Macromitrium eddyi* B.C. Tan & Shevock, sp. nov.— Mindanao Island: Mt. Kitanglad Natural Park (this publication).

Macromitrium falcatulum Müll. Hal.— Mindanao Island: Banga in Zamboanga Province (Bartram, 1939; Tan and Iwatsuki, 1991).

Macromitrium foxworthyi Broth.— Mindanao Island: Sax River in Zamboanga Province (Tan and Iwatsuki, 1991).

Macromitrium fuscescens Schwägr. [syn. *M. semipellucidum* Dozy & Molk.] — Mindanao Island: Camp Keithley in Lake Lanao Province, Agusan Province (Bartram, 1939; Tan and Iwatsuki, 1991).

Macromitrium incurvifolium (Hook. & Grev.) Schwägr. [syn. *M. subtile* Schwägr., *M. subuligerum* Bosch & Sande Lac.] — Camiguin Island: Mt. Timpoong, Mt. Hibok-Hibok. Mindanao Island: Alag River (Tan and Iwatsuki, 1991; Linis, 2010).

Macromitrium longicaule Müll. Hal.— Mindanao Island: Mt. Apo, Mt. Kitanglad (Tan and Iwatsuki, 1991).

Macromitrium macrosporum Broth. [syn. *Macromitrium goniostomum* Broth.] — Mindanao Island: Mt. Apo (Bartram, 1939; Tan and Iwatsuki, 1991).

**Macromitrium microstomum* (Hook. & Grev.) Schwägr. [syn. *M. reinwardtii* Schwägr.] — Mindanao Island: Mt. Apo (this publication).

Macromitrium mindorense Broth.— Mindanao Island: Davao Province (Tan and Iwatsuki, 1991).

Macromitrium ochraceum (Dozy & Molk.) Müll. Hal.— Mindanao Island: Mt. Malindang, Mt. Kiamo, Mt. Limbawon (Bartram, 1939; Tan and Iwatsuki, 1991; this publication).

Macromitrium orthostichum Nees ex Schwägr.— Camiguin Island: Mt. Timpoong, Mt. Hibok-Hibok. Mindanao Island: Sax River in Zamboanga Province (Bartram, 1939; Tan and Iwatsuki, 1991; Linis, 2010).

Macromitrium salakanum Müll. Hal.— Camiguin Island: Mt. Timpoong, Mt. Hibok-Hibok (Bartram, 1939; Tan and Iwatsuki, 1991; Linis, 2010).

Macromitrium salakanum Müll. Hal. ssp. *celebense* (Paris) M. Fleisch.— Mindanao Island: Mt. Apo, Sax River in Zamboanga Province, Agusan Province (Bartram, 1939; Tan and Iwatsuki, 1991).

Macromitrium sulcatum (Hooker) Bridel — Mindanao Island: Mt. Candoon (Bartram, 1939; Tan and Iwatsuki, 1991).

**Macromitrium tylostomum* Mitt. ex Bosch & Sande Lac.— Mindanao Island: Mt. Apo (this publication).

**Macromitrium yuleanum* Broth. & Geh.— Mindanao Island: Mt. Kitanglad Range Natural Park (this publication).

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